THE IRON TRADE REVIEW

A JOURNAL OF THE IRON, STEEL, MANUFACTURING AND TRANSPORTATION INTERESTS OF THE CENTRAL WEST.

VOLUME XXII. CLEVELAND, O., JANUARY 10, 1889. NUMBER 2.

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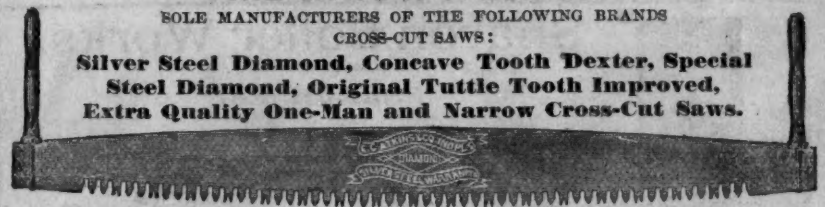

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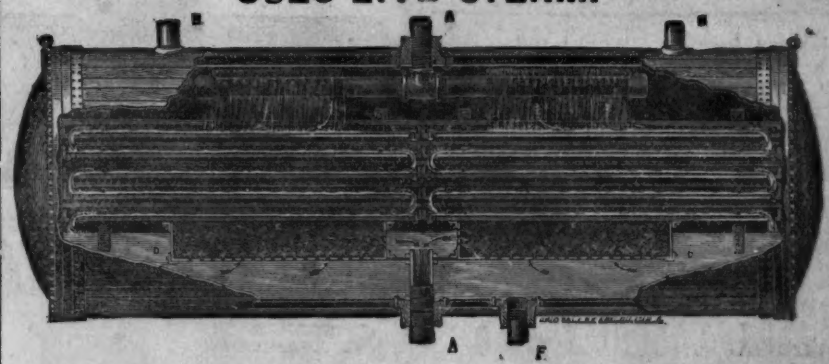

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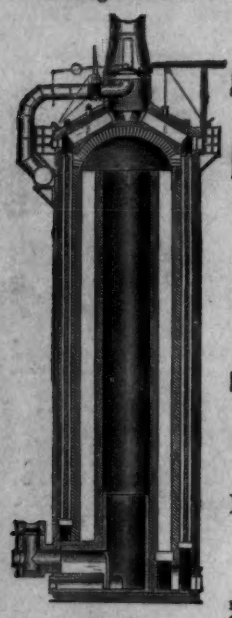

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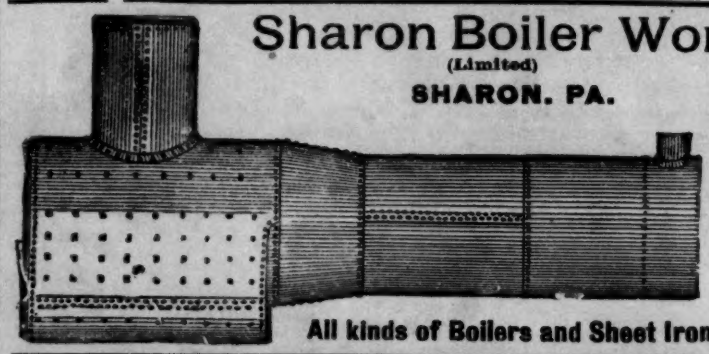

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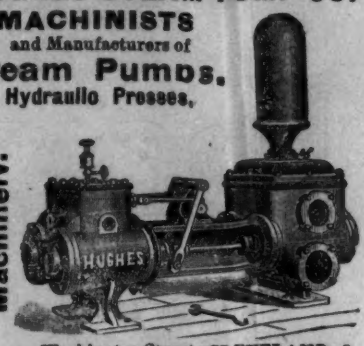

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Not dependent upon or operated by Steam Pressure, Condensation or Gravity.
Not affected by changes of temperature.

BEING operated by some moving portion of the engine or machine to be lubricated, the "Harlow Lubricator" starts and stops with the engine or machine being lubricated, without requiring the slightest attention from the engineer or operator, always delivering the oil in any amount from a drop to a constant stream.
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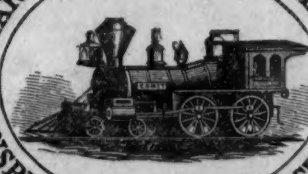

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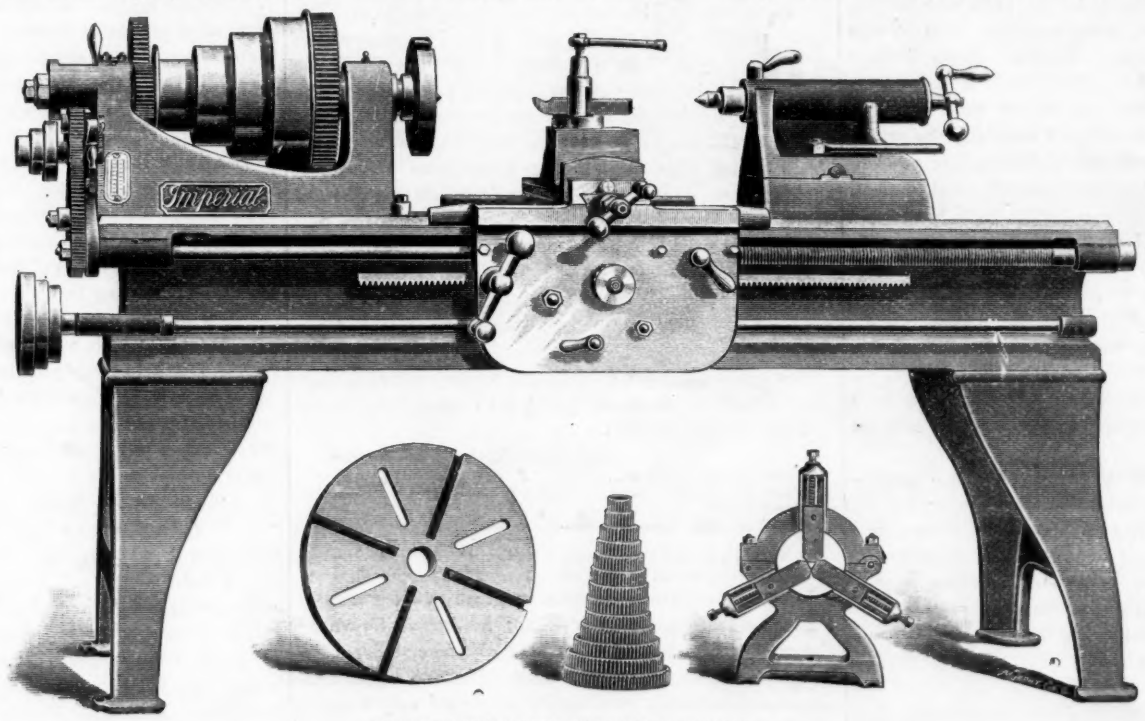
VOLUME XXII. CLEVELAND, O., JANUARY 10, 1889. NUMBER 2.

SEVENTEEN-INCH IMPERIAL ENGINE LATHE.

This lathe was designed by Messrs Lodge, Davis & Co., of Cincinnati, Ohio, to meet the demand for a tool without extra attachments, and is essentially a manufacturers' lathe. The name of "Imperial" was given to distinguish it from their original line of lathes that have a full set of extra attachments. While the Imperial lathe will be without compound rest, taper attachment or automatic stop, the quality of the material and the workmanship will be fully up to the high standard of their original lathes.

After a most careful study of the true requirements necessary to produce a first-class tool, the builders decided that a solid bearing, bored taper, with the spindle turned from crucible steel, as hard as it can possibly be worked, makes the best possible construction. There is much less liability of its losing alignment, there can be no tinkering with half-boxes, no looseness of spindle in bearings, but as near to absolute solidity as is attainable. The head is designed with a special view of securing great strength for end thrust. Being hollowed out sufficiently to make room for a cone pulley and belt, the front and back are carried up as high as possible, and webbed clear across from end to end, making two beams, well tied together, and capable of resisting the most severe end strains. Any wear on the spindle or bearings is taken up by drawing the spindle toward the back end. The part to which the adjustable screw is fitted is cast with and forms part of the head. Using solid bearings has been objected to on account of taking apart and putting together of the head. This difficulty has been overcome by a means of taking out the key that fastens the face wheel, through the hub. No difficulty whatever, we are told, is experienced in taking the lathe apart. This little matter, simple as it seems, has probably deterred many makers from adopting this construction. The screw cutting arrangement (which cuts from 4 to 20 threads to the inch) is driven from the spindle on the outer end. The reverse plate is made particularly strong, the studs being part of the plate itself, and therefore cannot become loose. Great care has been taken in this particular in order to make it meet the demands made on it when cutting heavy screws.

The gearing is arranged so as to be close to the bearings. The lead screw, which is directly under the front of the lathe, is engaged by two half nuts fitted directly to the carriage, not fastened to the apron, and the whole design is so arranged that no part depends upon the strength of either bolts or screws when chasing. The opening and closing of the half nuts is performed by a cam of new design which is very simple, durable and effective, locking itself both ways and operated from the front. The feeding devices are of the most substantial character, and no worm or worm gears are used. The tool block is of substantial design, and has a bearing on the cross side of the carriage of 18 inches. The tool post has a bearing in a square shoe, bored out so as to give full bearing to resist the heavy strain of the cut and the continual tightening and loosening of the tool. The front bearing tapers 1 inch in its length, and is 2⅝ inches in diameter. The lathe is furnished complete with all screw-cutting gears, large and small face plates, steady and follow rests, and full countershaft, which has 12-inch tight and loose pulleys, and which should run 130 revolutions per minute. The lathe is made with 6, 8, 10 and 12-foot bed, and of 17-inch, 21-inch, 24-inch and 30-inch swing.



SEVENTEEN-INCH IMPERIAL LATHE.

Ohio Capital in Old Virginia.

We learn that Chamberlain, Wheeler & Co., Walter Craft and Harry D. Turney, of Columbus, V. Ferguson, of Buchtel, and A. Magoon, of Logan, have leased for a term of years, the Victoria furnace in Virginia. This is a large furnace on the Chesapeake & Ohio railroad, near Goshen, and was built about six years ago by a company of English capitalists. The furnace has been out of blast for some time but, when running, it uses the rich, brown, hematite ores mined on the company's land and New River (W. Va) coke. The company also owns a short line of railroad running from the furnace past the famous Rockbridge Alum Springs to their ore banks, which is well equipped with engines and cars. The furnace, railroad and everything connected with the plant are constructed with the thoroughness and disregard of cost for which the English are noted, and has a capacity of 150 tons of an excellent quality of pig iron per day. There are two very successful furnaces in the neighborhood, Longdale and Lowmoor, and it is claimed that they can make iron at a cost not exceeded $12 per ton. It is currently reported that Mr. Magoon will go to Victoria as general manager.

German Steelmaking.

Large purchases of steel blooms and other steel are stated to have been made recently in Germany upon American account. Messrs. Sturm Brothers, Messrs. Wendel, the Dudelange Steel Works Company, the Rhine Steel Works Company, and the Phœnix Company are stated to have received orders which will occupy them until March, 1889.

TENNESSEE manufacturers are complaining against a law which taxes their capital stock. An organization will be formed to fight the law.

LUBRICATION OF STEAM SURFACES.

Power—Steam.

In reference to a remark by Prof. Denton, at the Scranton meeting of the American Society of Mechanical Engineers, regarding the lubricating effect of water in steam, Mr. W. E. Crane told of a thirty-inch Corliss engine which was supplied with steam through over 200 feet of 10-inch pipe, and which required a large amount of cylinder oil to keep it properly lubricated. The pipe was finally covered, when it was found that the amount of oil required was materially reduced. Changes occurring after about four years required a re-arrangement of the piping, and for a time this long pipe was again left bare with the same results as regards lubrication, the difficulties being again removed when the pipe was covered. The water present from condensation evidently increased the quantity of oil required, as it diminished both times when the pipe was covered.

It is true that engines have run for many years without any oil in the cylinder, but the friction must have been very great. In illustration, he told of an old style locomotive, in which a plain slide valve was used for a throttle. In order to make this throttle work easier, an oil cup was placed in the dome just over the steam pipe, with a small pipe leading downward. Before steam was raised the fireman would pour some oil into this cup and pipe, which oiled the throttle valve. The engineer in charge of the engine so fitted, was afraid the oil would get into the boiler and induce foaming, and instructed his fireman not to use any oil upon the valves. The fireman, having the switching to do, was anxious the throttle should work easily, and one morning, without the engineer's knowledge, poured some oil into the cup. He started the machine out of the house, and found that the throttle was all right, but thought that he would let the engineer find it out for himself. When the train was made up and the signal given, the engineer, as was his wont, braced his feet, took hold of the handle with both hands, and pulled with all his might. There was not so much friction there as there had been, the handle straightened out, and the engineer found himself back in the tender.

THE largest coal dock in America will be built at once at West Superior, Minn., by the Eastern Railway Company. It will be 2,000 feet long and 800 feet wide, with a central vessel slip 2,000 feet long and 100 feet wide, giving 8,700 feet of dock frontage for unloading cars. Tracks will run all through the structure, which will have a storage capacity of 1,500,000 tons of coal.

SOME large New York shipping merchants are considering a plan of establishing telegraphic communication with the light ships along the shore.

THE Western Union stretched its wires 90,000 miles of additional territory last year—enough to go around the word nearly four times.

METAL FOR HEAVY GUNS.

New York Tribune.

The bursting of the six-inch rifled gun cast of Bessemer steel, on the Ordnance proving ground a few days ago, has been followed by a good many "I told you so's!" Not enough has yet been disclosed to determine the unfitness of cast steel for heavy ordnance, nor that its failure was due to experiments with a new process of tempering. Dr. Gatling's opinion is that the failure of the gun grew out of its being cast whole; that had it been cast with a core and cooled from the center (the Rodman process), the gun in all probability would not have burst. Commodore Sicard, chief of the Bureau of Ordnance, says that during the process of boring and rifling it was discovered that the steel contained many little globular spaces, or "chambers," caused by the gases becoming imprisoned in the cooling metal while endeavoring to force a way through the molten mass. They were not large, ranging from the size of a pinhead to three or four times that size, but their tendency was to weaken the resisting power of the gun. Ensign Dashiell, one of the officers who made the tests with the gun, says that the experiment proves that Bessemer cast steel will not do for great guns; it has not the elasticity nor the tensile strength needed, and it showed weakness at the breech, where it ought to have had strength.

The word "steel" as used now is comprehensive, embracing material running from a pure quality of iron, with little or no carbon, and a tensile strength of 55,000 pounds, up to tool steel with a high percentage of carbon and a tensile strength of over 150,000 pounds. Experts speak of the former as "mild steel," and the latter as "hard steel." In the specifications of the Ordnance office of the War Department for bids for hoops for eight inch guns, a tensile strength of not less than 100,000 pounds per square inch is required. At a recent convention of the Naval Institute "Steel for Heavy Guns" was discussed by 36 civil and mining engineers of prominence, manufacturers of steel and Army and Naval officers. Edward Bates Dorsey advised the use of the ordinary mild steel of commerce. Dr. Gatling also advocated the use of mild steel, as hard steel, even when it is well and carefully tempered, is far more treacherous and easily broken or fractured when subjected to violent shocks than soft or mild steel. He said:

"The repeated firing of a gun will produce what is known as the fatigue of metal, and when that occurs and the metal becomes more or less crystallized, the life time of the gun may be said to be at an end. At all events, when a gun gets in such a condition it becomes liable to burst and is dangerous to the men using it."

Professor Thurston referred to a steel made in a crucible and containing about 8-10 per cent. of carbon. He says of this:

"It is possible that this metal can be used in ordnance; but it would be wise to settle the question on the small scale first, by using it in steel howitzers, and to defer the making of a large gun until the smaller sizes had proved safe. The process of oil tempering is one which has given remarkable results on a small mass of even high tool steel; but it still remains to be shown that great masses are to be safely treated for ordnance purposes in this way."

Thomas C. Clarke, a civil engineer concerned with Mr. Dorsey in the use of mild steel, or steel of a low carbon, said:

"It seems reasonable to suppose that high steel forged into hoops for guns would behave in an uncertain manner, while low steel would give uniform results."

Professor Egleston, of the Columbia College School of Mines, said:

"The limit between steel and cast iron is not wide, but the difficulty of managing it is no greater now than of learning how to make cast iron guns of large size was when the cast iron guns of General Rodman were of superior quality, and he educated the country up to his ideas. We shall have to do for steel what General Rodman did for cast iron. One of the greatest difficulties in manufacturing steel in large masses is that people insist upon hammering it, and, so far as large masses of steel is concerned, they never should be touched with a hammer in any stage of their manufacture. Hammering generally makes steel brittle, except in very small sizes. * * * As it is impossible to entirely prevent the occlusion of large quantities of gas and the consequent blow-holes, and the concentration of impurities by liquation from the top toward the bottom, and from the sides towards the centre, powerful presses are the only way in which such large masses of steel should be treated."

Lieutenant-Commander Barber, of the Navy, an ordnance expert, said:

"The statement that mild steel is the most reliable of all cheap metals, and that it can be badly worked and maltreated with impunity has not been borne out in Naval experience. There probably never was as good, and certainly never any better, steel put into vessels than the Atlanta, Boston, etc. This steel was obliged to show 60,000 pounds tensile strength, and 23 per cent. elongation as an average on test pieces for hull material. * * * Midvale and Cambria in the United States, Creuzot in France, Whitworth in England, and Krupp in Germany would all differ from the essayist in the idea that the failures of modern guns are largely due to defective oil-temper."

Lieutenant W. H. Jacques of the Navy said:

"Is it then of such material as Mr. Dorsey advocates that military engineers should construct guns to sacrifice their country and their fellows? * * * Is it with such material that we are to invite similar failures to those he condemns in England? I am sure no ordnance officer in either of our departments would dare to do it, if he were required to stand by and fire his own guns. * * * The steel we want for guns cannot be described by either of the terms 'mild' or 'hard;' it must be tough and elastic."

STEAM vs. GAS ENGINES.

Jos. J. Harrop writes the *American Machinist:* Having read the article by Geo. B. Grant, in the *American Machinist*, No. 52, Vol 11, I would like to offer a few figures in favor of the gas engine, which, I believe, will demonstrate that the gas engine would cost less to operate than the steam engine (as in the above case).

Assuming that the steam engine cost $400 and the gas engine $1,100, the interest, tax and repairs would be for the steam engine $40, and for the gas engine $110. The steam engine would require half of the time of one man to fire, oil and clean the engine, which, at $1.50 per day, would be for one year (300 days) $225. The gas engine would only require one tenth as much, which would be $22.50. The cost of fuel would be for the steam engine, about five lbs. per horse-power per hour, twelve hours per day (this comes from banking the fire at night or lighting it in the morning), and at five dollars per ton would be $150 per year.

The gas engine, with oil at seven cents per gallon (the price here per gallon by the barrel), would cost seven-tenths of one cent per horse-power per hour, or $84 per year.

The heating for five months (21 weeks) at five dollars per ton for coal, would be for 6½ tons about $33; therefore the recapitulation:

	Steam Engine.	Gas Engine.
Interest, tax repairs	$ 40.00	$110.00
Fuel	150.00	84.00
Attendance	225.00	22 50
Heating	.....	33 00
Total	$415.00	$249.50
Balance in favor of gas engine		$165.00

Mr. Grant makes a mistake when he puts the coal at 4 lbs. per horse-power per hour; he forgets he would either have to bank his fire at night or else fire up a cold boiler in the morning, both of which operations would require extra coal, while he would only have to spend 15 minutes twice a day to clean and start the gas engine. And then, again, $1,100 is a high price for an 8 horse-power gas engine (per my catalogues, $800 would be about right). This would make $30 more in favor of the gas engine, or $195.50, which, in ten years, would buy three or four steam engines. The steam pipes for heating would cost about the same, or more than the stoves.

The Last of the "Great Eastern."

A three days' sale by auction of the entire vessel and her fittings has taken place at Liverpool. The catalogue contained 893 lots, and as a rule, satisfactory prices were obtained. The hull and fittings realized over £43,000, the copper bringing £2,960; the gun-metal, etc., £4,480; brass, £3,980; lead, £4,185; outer iron plates, £12,500; inner iron plates, beams and rivets, £12,230, and anchors, about £300. The engines and engine fittings sold for about £10,000 in addition, bringing up the total to more than £50,000. The breaking up of the steamer will commence on January 1, will occupy a year, and will, it is estimated, cost in labor from 10s. to 15s. per ton of material.

A NEW YORK Court has decided that a strike is no excuse for not fulfilling a contract.

LARGE ADDITIONS TO RAILROAD EQUIPMENT.

Railroad Gazette.

The enormous railroad building of 1887 must naturally have been followed by large additions to equipment. The year 1888 was one of reduced net earnings and heavy expenses, nevertheless the output of locomotives was probably greater than in any preceding year except 1882, and the output of cars has been very close to that of 1887, if not greater, and probably greater than in any other one year. Last January we published the number of locomotives built yearly by 19 private firms from 1880 to 1887 inclusive. No attempt was made to get the number built by the railroads. The greatest number of locomotives built by these 19 firms was 2,282, in 1882. In 1887 they built 2,044. In 1888 17 firms built 2,180 locomotives, and 66 railroad companies in the United States and Canada built 382. This is undoubtedly very near the whole year's output. The 17 firms of locomotive builders include all of the large builders, and all whose product has been important. Replies were received from 108 railroads, and the 66 which built locomotives include all of the larger companies, and nearly all of which build any locomotives. The average annual output of the 19 firms from 1880 to 1887 was 1,645 locomotives, and the least number built was 800, in 1885. Of the 17 firms, only one built over 700 locomotives. The next largest product of one firm was 301. There were three firms which built over 200 locomotives each, and seven building over 100. Besides the locomotives, there were 17 Rotary snow plows built.

The cars for freight services built in 1888 were, by 37 firms, 62, 280, and by 66 railroads 19,910, or 82,190 in all. It is impossible to say what percentage of the output of the year these figures represent, but it must be a very large part of the whole. In 1887 the cars built to run in freight service were, by 15 car works, 23,775, and by 29 railroads 6,426, or 30,201 in all. It is seen that the number of cars built increased in 1888 in greater ratio than the number of companies reporting, which, in itself, would indicate that the output has actually increased. On the other hand, those car-builders who reported in both years almost without exception built somewhat more cars in 1887 than in 1888, the net result for the 15 firms being a decrease of about six per cent. in the latter year. This is the closest approximation that our returns will enable us to make to the relative activity of the freight car business of the two years. Among the 21 car works reporting for 1888 who did not report for 1887, are 10 which built over 1,000 cars each, five which built over 2,000 cars each, and three which built over 3,000 each. These 10 large producers were enough to raise the average so as to account for the fact that while the number of cars built has increased more than the number of cars works reporting, the individual works reporting in both years show an actual, but slight diminution of activity. Of the 36 car works, one built over 5,000 cars for freight service, four built over 4,000 each, 10 built over 3,000 each, 12 built over 2,000 each, and 20 over 1,000.

The same car works and railroads report cars built to run in passenger service as follows: By 36 car works, 1,954; by 66 railroads, 517; total, 2,471. In 1887 15 car works built 561 cars for passenger service, and 29 railroads built 169, or 730 in all. In every case where one car company has reported for both years, the product of 1888 is considerably increased over 1887, and it is a fair persumption that the passenger car business was generally more active in 1888. There were four works that built over 300 passenger train cars each. On the whole, in spite of the great falling off in railroad construction, and notwithstanding the decrease in net earnings, the year 1888 was one of the three years of greatest output of rolling stock, and the amount turned out was nearly, if not quite equal to that produced in 1887 or in 1882.

Pig Iron Production of the South.

Special reports to the *Manufacturers' Record* show that the total production of pig iron in the South last year was 1,065,000 net tons. Of this Alabama made 341,000 tons, Tennesee 278,000 tons, and Virginia 217,000 tons. This is an increase of 136,000 tons over 1887, while in the rest of the country the production of pig iron was about 500 tons less than in 1887.

THE first railroad train to the City of Mexico arrived from Laredo, Tex., some days ago on the new railroad. President Diaz took part in the celebration of the event.

THE BOILER ROOM.

BY J. F. ELSOM.

Written for the IRON TRADE REVIEW.

A visit to some boiler yards will disclose the fact that in this age of hurry and bustle, the true principles of physics governing boiler-making are rapidly being overlooked or considered beyond the comprehension of the workman whose ears have become heavy with sound.

Again, those who read cannot but have noticed the frequency of boiler accidents and the direful results, the collapse of flues vieing in frequency with low water and blow-ups. These have become dangerous nuisances. Concerning flue collapsing, it is well known to practical engineers that the resistance of wrought iron to the compression strain to which a flue is subjected is far below its power of resistance to its tension strain, and here begins the violation of one of the fundamental principles of physics.

Diameter, it must be remembered, is a great factor in either weakness or strength, for the larger the flue the greater is its tendency to collapse, and if any changes are perceptible at all, the natural tendency is to increase the size of the flues. Furthermore, the greater the length of the flue, without support other than its own structural strength, the greater the prospects of an early collapse, and boilers gradually grew longer; but this difficulty became so apparent by frequent collapsing that it has been obviated by the introduction of flanges or supports at different points in the length of the flue.

In theory, a flue when perfectly cylindrical is in the best possible form to resist the influences tending to collapse, inasmuch as the pressure is all then resolved as compression on the material. Should, however, any deformation from the perfect cylinder in the shape of the flue occur, the tendency to collapse is very much increased in the direction of the deformed or flattened sides. In all cases, then, when flues collapse, it is highly probable that they show a previous deformity in the direction in which they are about to collapse, and the proper notice of this change of form would frequently suffice to warn the engineers in charge, who might, by staying, prevent ultimate collapse; or, at all events, reduce the working pressure, until all danger was past.

In many instances, however, the engineer is not the only one to blame. I have noticed a growing tendency among boiler makers to construct boilers on the most inconsistent plans to withstand sudden changes of temperature and pressure. In the average boiler yard one may see long, heavy boilers, with large flues running the entire length, with no support save the natural strength of the metal, often punched, patched, and riveted out of all proportion. It has been claimed that metal punched and then filled with rivets, while hot, and thoroughly upset is as strong as whole iron, but when we take into consideration the fact that by virtue of the hot rivet (often scarcely filling the hole) contracting causes the tight seam, and in contracting is decreased in diameter, this argument lacks pertinence.

Speaking of longitudinal flues, boiler makers generally have built without due regard to supports, but no use to urge a change at this time. Again, many boilers explode from improper setting. In all cases, the entire boiler shell should be covered with brick work, leaving air space between the two and the top lining covered with an arch, eighteen-inch spring, built of fire brick. Outside of the arch the side walls are built to an even height with the top of the arch, the end being closed by means of a sixteen-inch wall from the foundation up to and including the arch.

In this wall are made two flue openings, one near each side; for instance, there are four feet of wall in the middle, and at each side of it there is an opening of say a foot and a half square, these being connected with the chimney by means of a suitable flue of proper dimensions. Iron braces are arranged for supporting the longitudinal walls, being stayed by means of bolts in the usual manner.

For the burning furnace and the fire place, both being nine feet in width and twenty-seven feet in length, a foundation wall suitable for these two sections having been provided, the walls, sixteen inches in thickness, are built up to about fourteen inches above the level of the floor proper, leaving in the end wall ample space to serve for easy entrance to the ash pit.

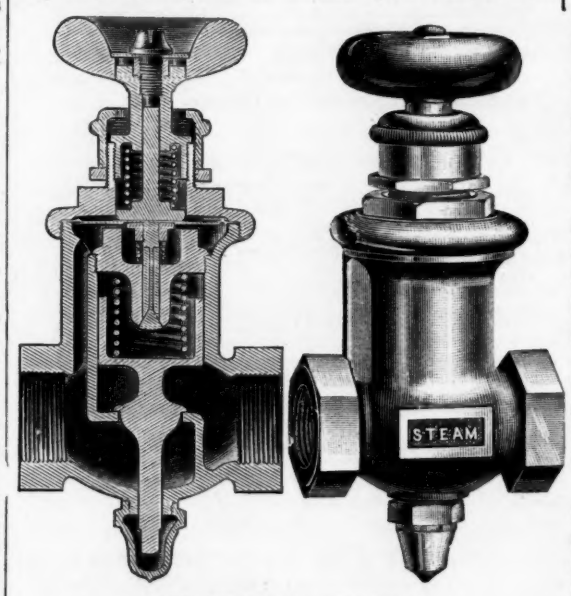
The bridge wall for these furnaces should be built two feet thick at least, and should be built up to the same height as the side walls, leaving a space of not less than five feet between the inside of the end wall, then the bridge wall will serve for the fire place dispensing with our special wall for this purpose. There is another cross wall, twelve inches thick, and of even height of the side walls, about eighteen feet back from the bridge wall, the reasons for which will be readily seen.

I have been thus explicit because so many fail to attain desired results with furnaces and heat used more than once. It should be borne in mind that in reclaiming we have one solid, another fluid, and a third gaseous body, heat being responsible for each condition. The general laws of heat then, are: first, that bodies expand when their temperature is increased (caused by their particles becoming farther apart). Gaseous bodies respond to heat in like manner, and as boiling is really the principle repesented in this subject, the whole process is really one of expansion, something that all ought to remember, hence anything that gives an increased attraction to the particles of a substance will eventually raise the temperature to the boiling point, the same rule applying, with nearly all its force, to substances dissolved in water. The attraction of the two substances overcome, the process is complete and we have the precipitate required.

A New Use for Electricity.

Modern Light and Heat.

One of the most interesting applications of electricity that has lately been announced, is the process of Mr. Elmore, an English inventor, for producing copper tubes by electrolytic deposition. For this purpose the inventor employs a mandrel of iron which is placed in a bath of the copper salt and suitably connected as the cathode of an electrolytic bath, and upon this the copper is permitted to deposit until it has acquired the necessary thickness. To insure uniformity of thickness of the deposit, the tube is slowly rotated in the bath; and he likewise employs the ingenious artifice of making the metal very dense by causing a burnisher constantly to travel over the surface of the tube as it is forming. By this means an exceedingly compact, seamless tube of copper is produced of any desired length and thickness, which is removed from the mandrel by the simplest mechanical means. These tubes are said to be produced very economically so that the process is now being operated on the commercial scale with success. The tubes thus produced are said to be in all respect of superior quality, and are highly recommended for boiler tubes and other uses where the employment of strong, seamless copper tubes is indicated.



THE CURTIS REGULATOR.

A Big Coal Company Organized.

A gigantic corporation has just been organized at Pittsburgh, known as the Wheeling, Lake Erie & Pittsburgh Coal Company. This company has bought all the valuable coal lands along the Wheeling & Lake Erie extension. This coal field begins a little below Steubenville, touches the Ohio River about Portland, and consists of many thousands of acres of rich coal fields. The Wheeling & Lake Erie road is at present completed to Bauerstown, and extensive coal fields in that neighborhood have already been tapped. The extension will be built right through this district to Portland and Martin's Ferry, a distance of forty miles. A large force of men are at present at work. The coal land owned by the company has been secured at a low figure. The capital of the company consists of $1,000,000 in bonds and $1,000,000 in capital stock. The plans for operation are on an equally gigantic scale. The company will command the same prices as do the operators here, but will only pay the Hocking Valley rates.

THE CURTIS REGULATOR.

We present to our readers an illustration of an improvement upon the well-known Curtis pressure regulator, by which the requirements of railroad service are met in a simple and satisfactory manner.

The ordinary operation of the regulator is as follows:—

The sectional view shows a main valve operated by a loose-fitting piston; a secondary valve in the top of the chamber over the piston; a metallic diaphragm (performing the double office of operating the secondary valve and making a joint to the cap which contains it), and a side passage connecting the chamber under the diaphragm with the outlet.

When the spring over the diaphragm is compressed, the diaphragm gives way, and thus opens the secondary valve upon which it rests.

Pressure being let on, raises the piston, and therewith the main valve, to its full capacity.

The main valve remains open until the back pressure communicated from the outlet through the side passage is sufficient to raise the diaphragm, and thus close the secondary valve, when the steam or water escaping around or through the loose-fitting piston fills in the space on top of said piston and forces it towards its seat, thus uniformly maintaining the pressure at which it is set; but in operation for railway car-heating, experience has demonstrated that it is desirable to be able to give an extra pressure at first in a cold train, in order to heat up quickly, also that the pipe connection may be injured by an undue pressure.

The improvement above mentioned consists in threading the top collar or extension of the cap (which contains the regulator spring), outside as well as inside and putting on to it a threaded sleeve, having a shoulder, which is adjustable, so that it can be set to stop the movement of the handle in one direction, while the extension of the top cap forms a stop in the other direction.

It has been found that 50 pounds pressure is as high as is needed to heat a train quickly, so the extension of the top cap is carried up just so far that, when the top handle is turned down hard on to it, the spring is compressed to produce 50 pounds and no more in the steam pipes.

The threaded sleeve is also adjusted so that when the top handle is turned out until it strikes the collar on the sleave the minimum pressure, say 10 pounds or 5 pounds, will be produced, and the sleeve when so adjusted is locked firmly to the cap by the lock-nut underneath it.

The operation is as follows: When the engineer connects with a cold train, he turns down on the top handle as far as he can, and leaves the regulator to take care of the pressure, assured he will get no more than 50 pounds in the system.

When the train is hot, he turns back on the handle as far as it will go, and the regulator adjusts the pressure to, say 10 pounds, the normal amount required to keep the train hot; he can make this minimum more or less in one moment, by starting the lock-nut and screwing the sleeve down or up; but when once the sleeve is set and clamped, the top handle can be locked by a hard turn against the shoulder, so that no jarring of the engine will disturb it.

It is obvious that the engineer can set his pressure either way in the dark, and make no mistake, and the same movement fastens the handle firmly in its place. These valves are made with outlets from 1 to 1½ inches pipe thread to engage with different sized steam fittings, and are made and sold by the Curtis Regulator Co., of Boston, Mass.

Shipbuilding in Canada.

The shipuilding trade in Canada has been very dull for many years, owing to wooden ships having given place to iron and steel vessels. It has been proved, however, that ships of iron and steel, as well as of wood, can be built in the Dominion. Last year, a very large iron sailing ship was constructed in the Maritime Provinces, and this year a new steel steamer of 2,000 tons has been commenced at Owen Sound for the lake traffic of the Canadian Pacific Railway Company. Within the past few weeks a steel steamer has been launched at Montreal for the Ottawa river trade. She is 170 feet long, 41 feet broad, and 9 feet deep. The engines and boiler, as well as the hull, were made in Canada.

IT is estimated that at least 50 per cent. of the gas now used in the Pittsburgh mills is lost through ineffective methods and bad management.

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OUR "TEXAS SIFTINGS" OFFER.

Gratifying responses have been received to our offer of *Texas Siftings*, the well known humorous paper, *free* to all new and renewing subscribers to the IRON TRADE REVIEW, who remit our regular subscription price, $3.00. This is a unique and extraordinarily liberal clubbing arrangement, but we are enabled, by special arrangement which no other paper in Ohio can secure, to carry it out to the letter. Remember, that our offer only extends to the 1st of February, and that by subscribing now, you get the IRON TRADE REVIEW (a $3.00 paper, well worth the money) and *Texas Siftings* (a $4.00 paper) for simply the price of the REVIEW.

BUSINESS FAILURES OF 1888.

There were 9.7 per cent. more failures in 1888 than in the preceding year, but this fact is of no special significance when it is considered: (1) that there was a decrease in the liabilities of 10.5 per cent., and in the assets of 4 per cent.; (2) that out of the 847 failures which mark the increase in 1888, no fewer than 475 occurred in the last three months of the year; and (3) that for the past three years, following the New York panic of 1884, there has been a decrease in the total annual number of failures.

The relative situation of the past year in comparison with previous years is compressed into the following table, taken from *Bradstreet's* (the assets and liabilities being given in millions and tenths of millions of dollars):

	No. Failures.	Per cent. increase or dec.	Total Liabilities.	Actual Assets.	Per cent. assets to Liabilities.
1888	10,587	*9.7	$120.2	$ 61 9	52.0
1887	9,740	17.8	130.6	64.6	49.5
1886	10 569	†4 9	113.6	55.8	49.0
1885	11.116	†1⅓	119.1	55.2	46.0
1884	11.610	*13.7	248 7	134.6	54.0
1883	10,299	* 4 0	175.9	90.8	51.0
1882	7,635	*28.0	93.2	47.4	51.0
1881	5,929	.....	76.0	35 9	47.0

*Increase. †Decrease.

As a whole, therefore, the year 1888 was a generally prosperous one in the mercantile world, though it is worthy of remark that of the 847 increase in the number of failures, 511 were in 12 Western States (Ohio to Colorado, Kentucky to Minnesota). On the other hand it may be said, that in this territory the greatest expansion in trade has taken place, and here, therefore, the commericial death rate would materially be larger.

OHIO GAS AND OIL INVESTMENTS.

An intelligent correspondent of the Toledo *Commercial* has been making a calculation as to the amount of money invested in oil and gas lands in Northwestern Ohio—or rather in Wood county—since the present boom commenced. The first cost of a well he estimates at $2,000, on the basis of the following calculation:

Carpenter rig, $310; 5⅝ casing, 375 feet, $140 delivered on the ground; drilling 1,200 feet at 60 cents, $720; two 800 barrel tanks, $430; connections and pipe for lead lines, $60. Total, $1,660. Add a tank house at a cost of $85; and engine, cost $185; belts and other fixings $50; tubing, 1,200 feet at 12 cents, $144; rods and pumping outfit, $75. Total, $2,199. To this must further be added the expense of a boiler, but as one boiler answers for two or more wells, it could only be figured according to the number attached. Its cost is about $425. From this reckoning it will become plain that the estimate on the whole of $2,000 for each and every well sunk for gas or oil is below rather than above the actual cost.

There are, in Wood County alone, 250 wells. Based upon the foregoing calculation, the total investment has been as follows:

Article.	Total.
Wells, 250, at $2,000 each	$1,040,000
Labor on same after completion, one year	50,000
Iron storage tanks (Buckeye)	1,200,000
Pump stations, pumps and pipe lines (Buckeye)	2,00 ,000
Bonuses paid to farmers, aside from royalties	1,080,000
Cash royalties to gas land owners	1,500,000
Gas lines	500,000
Total	$7,370,000

If this be true of one county, what is the probable aggregate for the entire natural gas and oil district of Ohio?

OUR LAKE TRAFFIC IN 1888.

From the annual report of Hon. Wm. J. McKinnie, Collector of Customs for the District of Cuyahoga, it appears that the total receipts at the four ports included in the district, in 1888, were as follows:

	Value.
Cleveland	$45,750,572
Ashtabula	6,567,342
Fairport	3,126,407
Lorain	1,149,000
Total	$56,593,321

The total clearances were as follows:

	Value.
Cleveland	$41,047,585
Ashtabula (coastwise)	1,256,898
Fairport "	338,153
Lorain "	656,250
Total	$47,298,886

Foreign exports were as follows:

Cleveland	$ 75,161
Ashtabula	152,091
Lorain	23 071
Fairport	1,650
Total	$751,973

The value of foreign imports was $693,413.

Imports of domestic iron ore are reported as follows:

	Tons.	Value.
Cleveland	3,231,310	$16,156,550
Ashtabula	1,369,998	6,549 790
Fairport	614,067	3,070,335
Lorain	195,370	976,850
Total	5,350,705	$26,753,525

While the above figures are doubtless correct as to the manifests, they are far from correct as to actual receipts. The figures given by the IRON TRADE REVIEW, in its issue of December 6, 1888, were furnished direct from the railroads, and can be depended on. They showed iron ore receipts for the season as follows: Cleveland, 971.795 tons; Ashtabula, 1,288,530; Fairport, 611,140; Lorain, 197,000.

Exports of iron products from Cleveland for the year, footed up $1,797,038; imports of like articles at Cleveland, $651,999.

Shipments of bituminous coal were as follows:

	For Shipment.		For Fuel.		Total.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
Cleveland	1,627,825	$3,662,686	308,979	$772,448	1,936,804	$4,435,134
Ashtabula	499,062	1,122,890	57,603	134,008	556,665	1,256,898
Fairport	138,000	310,500	7,061	17,653	145,061	328,153
Lorain	270,000	607,500	19,500	48,750	289,500	656,250
Total	2,534,887	$5,703,576	393,143	$972,859	2,928,030	$6,676,435

There were built in the Cuyahoga district in 1888, 23 vessels (8 steel, 15 wood), with an aggregate gross tonnage of 32,366.12, and a total net tonnage of 25,923.88.

Canadian iron ore was received at Cleveland to the value of $39,066.

THE amenities of Lake Superior mining journals afford an interesting study. In a recent issue of one of our esteemed exchanges we find the following:

"The total output of the Old Mendacity for the year just passed was 777,777 tons. This is all the more remarkable because this enormous amount of ore was taken from a single 4x4 shaft. Captain Blowhard informs us that Old Mendacity will double this output next year.—[Vermilion Iron Journal."

The above we clip from the Norrie Mine *Tooter*, Bro. Flagg, editor. From the same paper we clip the following reference to the Norrie mine:

"SHE'S A DAISY."

"The Cyclopean Norrie, so the pumpmen tell us, will work every stope, drift, tunnel, crosscut, shaft, winze and 'rise' during the coming season, and by putting a man in every available spot of the Cyclopean Norrie, it will ship 500,000 tons of ore. While the 'Old Mendacity' at Tower will ship 777,777 tons from a 4x4 shaft, it is an impossibility to estimate what the Mendacity would ship if it was crowded like the Cyclopean Norrie, but we suppose the amount would be 2,222,222 tons. This is not very much, in the *Tooter's* opinion, because the product comes from 22 mines."

BY the way, will the IRON TRADE REVIEW be kind enough to specify by name that "Menominee mine which can produce ore at 30 cents a ton," and which, as it stated in its issue of the 27th ultimo, ma e "a profit of nearly if not quite 50 per cent." on its investment during the year just closed? Our iron men would like to take lessons of its managers. At the same time it might correct its statement concerning the Dunn ore, of which 7,000 tons (not 15,000) has been sent forward by rail since the close of navigation from the mine, not from Escanaba.—[Iron Port, Escanaba, Mich.

With the greatest pleasure. How would the Dunn do, for example? With an expenditure of about $100,000 for their lease, and say $40,000 for opening up their pits, as against a sale of 116,000 tons at an average price of $3.75, we think the profit will figure out about as stated.

THOSE of our readers who have been following the superb series of railway articles in *Scribner's Magazine*, will be especially interested in the very lucid explanation of "Railway Management" from an official point of view, by Gen. E. P. Alexander, President of the Central Railroad of Georgia, in the January number. The line of responsibility and duty from the president to the track-walker or switchman is outlined with remarkable clearness and precision—for the first time making plain to a general audience the workings of a most complex organization. Among the things explained are the handling of trains, involving the making of time-tables and the work or the train-despatcher; imperative rules for avoiding accidents; how freight and passenger rates are made, and how the earnings of a road are calculated. The illustrations are from drawings by Blum, Burns, and other skilful artists. It is announced that ex-Postmaster-General James will contribute to the series an article on the "Railway Postal Service."

MANUFACTURERS will read with interest, in the January *Century*, an able essay by Colonel Auchmuty, in which he tells about a new movement in connection with the subject of American labor. This essay is entitled "An American Apprentice System," and describes a new system of apprenticeship, which Colonel Auchmuty considers "suitable to American wants," and which he says "concerns in no small degree the welfare of the nation." The illustrative features of this number are especially noteworthy.

CHRISTMAS lore, travel and adventure, legend, cookery, toy-making, biography, poetry and what-not cram the pages of the January *Wide Awake*. Just the thing for the children and the young people. D. Lothrop Co., Boston, Mass., are the publishers.

A VERITABLE industrial magazine was the New Year's issue of the *Age of Steel*, St. Louis. Its list of contributors included the names of many well known writers on commercial and economic subjects.

THE *Metal Worker* (New York) has shown commendable enterprise by offering $300 in prizes for the best essays on "House Heating."

THE "complete story" feature of *Lippincott's Magazine* (J. B. Lippincott Co., Philadelphia) is to be continued this year. The January story is "Hale Weston," by M. Elliott Seawell.

THE Chattanooga *Tradesman's* New Year number was replete with statistics and special articles relating, to Southern industries. Congratulations.

NEARLY 40,000 men are employed in Pittsburgh iron and steel works. Their wages are nearly $34,000,000 per year.

THE Akron (O.) *Telegram*, of January 1, presented a very full industrial exhibit of that thriving city.

THE Akron *Beacon* issued a neat calendar, for a copy of which we tender acknowledgments.

THE BOOKWALTER STEEL ENTERPRISE.

The *Mechanical News* (New York), which is closely associated with Hon. John W. Bookwalter, says of his new steel process:

Within the past two or three weeks frequent mention has been made by the press in nearly all parts of the country of a new process for the manufacture of steel, arrangements for introducing which have recently been in progress, and the advantages of which are such that it cannot fail to produce most important results in that great industry. As the process has been brought out by the proprietor of this journal, John W. Bookwalter, a brief statement of its purpose and its relation to processes previously in use may not be out of place, and will doubtless be interesting to all classes of our readers.

To enter into all the details of the successive manipulations to which iron ore is subjected from the time it is taken from the mine to its ultimate appearance as a finished product in various forms, would exceed our limits and would be of slight interest to the reader. To deal with the matter generally, it may be sufficient to say that iron, although a pure metal, like copper, silver or gold, has, nevertheless, a marked affinity for various substances, such as sulphur, phosphorous and oxygen, but especially for oxygen. It is, therefore, practically speaking, never found in nature in a free or uncombined state, but almost always in the form of an oxide. To free it from the oxygen and other foreign elements which may be present in the ore, it is fused in a furnace, and by means of fluxes the desired separation is accomplished. The product, known as pig iron, although relieved of the oxygen contained in the ore, undergoes at the same time, in the process of fusion, a combination with other elements, especially silicon and carbon, these being present in varying proportions, but ordinarily to the extent of about two pounds of silicon and three of carbon in 100 pounds of the molten metal as it comes from the furnace.

To obtain from pig or cast iron the product known as wrought iron or bar iron, which is as close an approach as can be made to absolutely pure iron, it is necessary to eliminate the silicon and carbon contained in the pig iron. For the production of steel, however, which has the advantage over wrought iron that it is susceptible of being tempered in varying degrees, and thus adapted to a multitude of uses in the arts, it is requisite that a portion of the carbon should be restored to the wrought iron, from which, if the latter be pure, it is wholly absent; or, instead of recarbonizing the wrought iron, the same result may be attained by arresting the process of elimination of the carbon and silicon from the pig iron at such a point that it will still contain the proper amount of carbon—this varying, in different qualities of steel, from one-tenth per cent. or less to one and one-quarter per cent.

For a long time, and indeed until a comparatively recent date, the decarbonization of the pig iron was affected by the process known as puddling, in which the mass of molten metal is constantly stirred with a rabble, while the air and products of combustion by which the mass is kept in the requisite state of fluidity, are passed over its surface. In this manner the carbon in the metal is gradually consumed, and a very pure quality of steel obtained as the result. It might be said, in fact, that this process would leave little to be desired, were it not for two or three disadvantages, namely: the length of time occupied, the reduction of a single charge taking several hours; the large consumption of fuel necessary to keep the mass of metal in a fluid state; and the skilled labor required to insure a successful result.

These considerations rendered evident the desirability of an improvement in the methods employed; and some thirty years ago what is known as the Bessemer or pneumatic process was introduced. This may be called the rapid process, as contradistinguished from the slow process above described. In this, the removal of the carbon and silicon from the pig iron is effected by blowing air through the melted mass, the combustion of the oxygen and carbon serving to maintain the fluidity of the mass for the period—a short one as compared with that required for puddling—which is occupied in the process. But from the nature of this method it results that while decarbonization is effectually accomplished, other impurities are generated in the metal; and owing to these and the irregular texture of the steel thus produced, it is found unavailable for many purposes which call for steel of a very pure, regular and homogeneous quality.

The commanding merit of the process which Mr. Bookwalter has brought out, may be briefly stated to be this, that it results in even greater purity of product than is obtained by the puddling or slow process, and at the same time is even more speedy and more economical of fuel and labor than the Bessemer or rapid process, by which a comparatively imperfect steel is produced. A charge of molten pig iron which has been melted in an ordinary foundry cupola is converted by the new process in from five to eight minutes after being poured into the converter; and so perfectly is the fluidity of the metal maintained that the steel taken from the converter can be poured from the converter into the ladle, and over the lip of the ladle into the moulds, with the same freedom as the most fluid cast iron. In fact, if a casual observer were to enter the works where the process is now in operation at Springfield, O., he would suppose, except for other signs indicating the nature of the product, that cast iron instead of steel was being poured, so extraordinary is the fluidity of the metal.

The different grades of steel made by the new process cover a wide range, from an extraordinarily low carbon steel, practically wrought iron, to that of a highly carbonized quality. It is adaptable, therefore, to a corresponding diversity of uses, and to some for which steel as heretofore made has been unavailable either by reason of its cost, or on account of its imperfect quality. Castings of all sizes and forms can be cast with as much certainty as cast iron, very tough, sound, ductile, true to the pattern, and requiring no annealing. They can be taken direct from the sand and used in the machine shop. The different grades of low carbon steel made by this process possess extraordinary ductility and tensile strength; and the steel of all the various percentages of carbon, even the castings made from this metal, can be worked and welded as readily as wrought iron, without the use of fluxes.

As to the reduction in the cost of making steel which is attained by this process, a single brief but significant statement will suffice. It may be safely affirmed that, exclusive of the necessary buildings, a plant with all, the machinery required, having a capacity of 100 tons of steel in twenty-four hours, may be erected, ready for operation, at a cost not exceeding eight thousand dollars. Indeed, a plant can be erected so cheaply, and operated at so little expense, that it becomes a profitable investment, even for those who use no more than five hundred to one thousand tons of steel per annum, to put up a plant for the manufacture of steel for their own consumption.

The question will naturally arise in the reader's mind recalling the history of many projected improvements, discoveries and inventions of the past which have come to naught, whether this is but another experiment of hopeful promise but problematical results, or may be regarded as an accomplished fact. To quote the language of our esteemed contemporary, the *Tradesman*, of Chattanooga, Tenn.: "A great many processes of this and other kinds that promised great things when under preliminary and experimental operation have proven disappointing upon larger application. This has been peculiarly the case with steel making inventions; the expectations raised in the laboratory have been crushed in the furnace." It is proper to state, therefore, that the process here described has long since passed the experimental stage, and has been for some time in actual use both here and abroad.

In Europe, the excellent quality of the steel made by it is fully recognized, one instance of which is the fact that it is being used for the rivets of the celebrated Eiffel Tower in Paris, which is to overlook the Exposition, this year, from a height of 1,000 feet. Nor is this process a secret operation around which any mystery is sought to be thrown. The works in operation at Springfield, Ohio, which are capable of making one hundred tons of steel in twenty-four hours, are open to the public, and may be visited by any one desirous of examining the process.

It is apparent, therefore, to summarize the matter briefly, that this process combines the advantages of both the methods hitherto in use, while avoiding the drawbacks of each; and that it may be considered as bringing to substantial perfection, as regards rapidity and economy of production, and the excellence of the article produced, the manufacture of the most important and widely utilized metal known to the arts of civilization.

THE AETNA MACHINE COMPANY, Warren, O., on last Saturday closed a contract with the Chicago Splice Bar Mills, owned by Morris Sellers & Co., of Chicago, Ill., to furnish them with a 500-horse-power engine, to drive a train of rolls in their mills, at Chicago.

AN IMMENSE BELT.

The American Wire Co., of Cleveland, are putting in place the heaviest leather belt in the city. It is 60 inches wide, 140 feet long, and weighs 1,593 pounds, being double thickness. It will drive about 1,000-horse-power at times, and will run from band wheel of a Corliss engine 24 feet in diameter, with 62-in. face and ¼-in. crown, running at a speed of 80 revolutions per minute, giving a belt velocity of over 6,000 feet or over one mile per minute.

This belting was made for this concern by the Jewell Belting Co., of Harttord, Conn., for whom S. M. York is agent in this city. This company are making a specialty of heavy belting, and are now putting in for the Washburn-Mœn Co., of Worcester, Mass., a 4-ply belt, which will weigh about 1¼ tons, and will drive 1,800-horse-power. This is probably the heaviest leather belt ever made. We understand that several of these large belts are to be put in place in Cleveland, further details of which will be given as they appear.

Invent or Move.

Manufactories were first built in New England to supply the wants of people who lived in New England. As other sections of the country became settled, New England was called upon to supply them with manufactured goods. The demand increased until New England was unable to furnish the desired supplies, and factories were established nearer the demand. As a natural consequence the supply, once inferior to the demand, has so increased that manufacturing, to a certain extent, in New England, is unprofitable. Manufacturers of standard goods are moving their establishments to locations where material is plenty and freights are reduced to the lowest possible figure. As men emigrated forty years ago, so must manufacturing concerns emigrate now, or they must become pioneers in some other direction.

The manufacturers and mechanics of New England must either "go West" and join the common herd, or they must go to improving existing methods, perfecting new processes, and devising means hitherto unknown. New England must, as manufacturing goes, become the leader in invention, and make up in brain work what is otherwise lost through the natural course of events.—[Manufacturers' Gazette.

Trial of a Forged Steel Projectile.

An important experiment at the naval proving ground was made last week at Annapolis, Md. An eight-inch piercing projectile of forged steel was fired against a compound plate of wrought iron and steel, manufactured by the firm of Cammell & Co., of Sheffield, Eng.

The plate was eight feet wide by six high and ten inches thick, and was supported upon a backing of oak twenty-four inches thick. The gun used was one of the new steel breech-loading rifles, belonging to the United States steamer "Chicago." The weight of the projectile was 250 pounds, and of the powder charge 126 pounds, giving the velocity of 2,000 feet per second. The projectile pierced entirely through the plate and lodged broken in the oak backing. The plate was cracked to the edge at two points. The performance of the projectile is considered admirable, and is most encouraging in the prospect it holds out of the successful development of steel forged projectiles in this country, it having been made and tempered at the Washington Naval Yard. Lieut. Austin M. Knight, Inspector of Ordnance, in charge of the proving ground, conducted the experiment.

The Greatest of Steel Users.

Manufacturers' Record.

Few persons are aware that in the year 1887 the consumption of iron and steel in the United States came to forty per cent. of the entire product of all the mines and works of the world; no other country could possibly supply us with this metal; we must make the larger part of our own supply whether we will or no. Whether we shall use the supply of crude materials on even terms with our competitors in other countries in making machinery, locomotives, marine engines and in building ships rests wholly upon removing the disparity in the price or cost of these crude materials to those who convert them into the higher forms for final consumption. How that disparity shall be removed, is the question which may now interest every student of economic science. That nation, or that section of any nation which possesses supremacy in the production of iron and steel and in their conversion to final forms for use, will dominate and control the commerce of the world.

AGENCIES.
NEW YORK, 109 Liberty street.
PHILADELPHIA, 2035 N. Front st.
MINNEAPOLIS, 210 South Third st.
CHICAGO, 218 Lake street.
ST. LOUIS, 707 Market street.
NEW ORLEANS, 21 Union st.

THE CURTIS

Regulators for Steam, Water, Air, and Pump Pressure.
STEAM TRAPS, RETURN TRAPS, DAMPER REGULATORS, SEPARATORS,
and other Specialties for the economical use of Steam. Manufactured by
THE CURTIS REGULATOR CO.
85 Beverly Street, Boston.

HIGH PRESSURES.

The Locomotive.

The tendency towards high pressures of steam in these days is becoming somewhat alarming, especially when excessive pressures are desired on boilers of large diameter. When the change was made from 48-inch boilers to 54 and 60 inches in diameter, it became necessary to see that the material and construction was such that the pressures required could be safely allowed. The difference in diameter of these large boilers, from the former types, was not taken into consideration by steam users generally. There seemed to be an impression that a boiler, no matter how large its diameter, could be safely used at any pressure desired. We were once told by a steam user that the larger the boiler, the better able it was to be used at high pressure, and he enforced his argument by saying that a large horse was stronger than a small one. With such crude ideas in regard to boilers, it is not strange that the desire to use boilers of large diameters at very high pressures is common; even boiler makers are not unfrequently imbued with similar ideas. They forget that the strength of the boiler is measured by its weakest point, and that point in horizontal tubular boilers is the longitudinal joint or seam. To make this more evident, we will illustrate it as follows: Suppose we have a boiler 60 inches in diameter. If we take a ring from this boiler one inch wide, we have in the entire circumference 188 inches and a fraction, or 188 square inches. If we put on this a pressure of 100 pounds to the square inch, we have 18,800 pounds tending to burst the ring assunder. This would be equivalent to nearly 9½ tons. Now multiply this by the length of the boiler in inches, and we have the force within the boiler, tending to rend it in pieces, which is found to be more than 1,700 tons. Now, we will suppose that we have a similar ring from a boiler 72 inches in diameter. We find that there are 226 inches in the circumference, or 226 square inches. If a pressure of 100 pounds per square inch was applied to this ring, the entire pressure would be 22,600 pounds, or 11 3-10 tons. If the boiler was 16 feet long, the entire internal pressure would be more than 2,137 tons. By such calculations we gain some conception of the destructive forces pent up in a large boiler under a high pressure of steam. As stated above, the seam or joint is the weakest point in the boiler. (We assume that the boiler is constructed of good material, and that the workmanship is good) If the joint is single riveted, it has only about 56 per cent. of the strength of the solid plate. If it is double riveted, it has a strength rarely exceeding 75 per cent. of that of the solid plate. So, however excellent the solid plate may be in tensile strength and ductility, only three-fourths of that strength can be depended on. But that gives us the bursting pressure, or the point where the quiescent is exceeded by the divellent force. There must be a factor of safety which may be 6, or in exceptionally well-built boilers, it may be 5, and in some rare cases 4. The percentage of the strength of the joint is no greater in the 72-inch boiler than it is in the 60-inch boiler, and if the same pressure is used, the strain on the large boiler is greater in proportion to the larger area of internal surface. This fact is often overlooked or forgotten, both by the purchaser and boiler maker.

If a high pressure is desired on a boiler of larger diameter, it should be plainly stated when a boiler is contracted for. Then a special joint can be made that will have a greater percentage of strength than the ordinary double riveted lap joint. Boiler makers cannot be too particular about these points in the construction of large boilers. To illustrate this still further, we will assume that a boiler 72 inches in diameter is constructed of ⅜-inch steel, with a tensile strength of 60,000 pounds, and the required ductility. The longitudinal joints to be double staggered riveted, rivets to be pitched 3½ inches from center to center, and three-fourths of an inch in diameter, what would the maximum safe working pressure be? We find from the construction of joint that it would have 75 per cent. of the strength of the solid plate, which would reduce the strength to 45,000 pounds per square inch. Now multiply this by the thickness of plate (three-eighths of an inch) and we have 16,875 pounds as the strength of the boiler, including joint. We now divide this by the radius of the boiler, 36 inches, which gives us nearly 469. We must now divide this by the factor of safety 5, and we have as safe working pressure 93 pounds to the square inch.

In boilers exceptionally well constructed, and where the plates have been selected and tested by coupons cut from them, a factor of safety of 4 may sometimes be allowed, though rarely. The foregoing will serve to show how important it is to recognize well-established rules in boiler construction. When boilers are built right and run at a safe pressure, they will give long service, and frequent repairs will not be required, unless there is carelessness in the care and management. We shall have something further to say about the high-pressure boilers in the future.

Natural Gas Privileges in Dispute.

Pittsburgh special, New York *Tribune*: An action which promises some interesting revelations and involves the ownership of the natural gas privileges of a valuable portion of the great Murraysville field, in Westmoreland County, was begun to-day. The suits were entered by Henry Remaley against the Pew-Emerson Company, (limited), and its successor, the Fuel Gas Company. Damages of $100,000 are claimed, equally divided between the two companies.

Remaley was jointly indicted with Milton Weston, of Chicago, A. M. Bowser and others for the murder of Obadiah Haymaker, during a battle for the possession of a natural gas well on Remaley's farm. Both Weston and the Pew-Emerson Company claimed to possess leases for the gas privileges, and this fact brought about the collision. Remaley was acquitted.

The plaintiff alleges that in 1877 he leased oil privileges to M. R. and O. M. Haymaker of six acres of his land, and that the defendents by assignment held this lease which does not include the natural gas product. In the Fall of 1878, he alleges, he leased to the same parties the entire tract, twenty-seven acres, and under the terms of this lease the stone, coal and gas were to remain with the plaintiff in fee simple. This lease also was assigned to the defendants. The plaintiff alleges that this lease was ante-dated to January 15, 1878; that he never acknowledged the execution of the lease; that the name of the justice of the peace before whom it purports to have been acknowledged was a forgery; that the procurement of the new lease was a fraud upon plaintiff, executed for the purpose of covering the well already bored, as the first lease did not include gas; and that therefore the gas produced from the well was his property.

Is Natural Gas Decreasing?

Toledo (O) Commercial.

No, natural gas is not decreasing, but the consumption is increasing. This is what is the matter with Findlay. It is in the very centre of the gas field. It rushed into the business of free gas. It went into debt a million in order to attract manufacturers. This seemed to be all right; but what is the result? There is no check upon consumers. There are no meters. Gas is not only used but it is wasted. The improvident live upon those who are more careful. The result is people are found hunting in the midst of the gas wells for wood to cook their breakfast. This is not because gas is giving out, but because it is wasted. This is something the people of Toledo should make a note of. They cannot afford to exhaust the supply by a course of wastefulness. By the same process our forests were destroyed. It was supposed there was no end to the forests, but there proved to be. It has also been supposed there would be no end to the supply of natural gas, but this is a mistake. It is proving a mistake at Findlay. It will prove a mistake at Toledo. It will prove a mistake in every gas field. The meters should, therefore, be applied in every house where natural gas is used, in order that everybody may pay for what he uses, and no more, and in order that no one shall waste the material at the expense of his neighbor or at the risk of exhausting the general supply.

A PENNSYLVANIA railroad official states that the road shows 10 per cent. increase of business in 1888 over the previous year.

STEEL RAILWAY TIES.

C. L. Taylor, civil engineer, in the *Railway Age*, makes the following comparison of the merits of steel and wooden railway ties:

Full average life of a wooden tie, six years; minimum life of a metallic tie, thirty years; value of material at end of each period—wood, 0; metal, ⅔ of first cost, less 5 per cent., loss by corrosion.

Estimate for an ordinary three-mile section of road:

Three miles of rail, 80 pounds per yard, will contain 377 tons. Steel and rails, $30 per ton. The necessary force would average—for wooden ties, 3 miles—for 4 men and 1 boss per day, $8; for 312 days, $2,496.

All items of labor not herein considered, are generally incident to both systems. The difference is so great against the use of the wooden tie in an economic sense, that some considerable items properly belonging to it were omitted entirely, both in labor and material.

METALLIC TIES.

Metallic ties, 3 miles—for 2 men and 1 boss per day, $5; for 312 days, $1,560.

Metallic ties, 377 tons by 16 4-5 per ton of rail or 6,333 3-5 ties at $2 25		$14,251.00
Labor, $1 560 per year for 30 years		$16,800.00
		$61,051.00
Cold metal, $20 per ton, ⅔ of $14.251		9,500.00
		$51,551.00
Due to corrosion		712 50
Total		$52,263.50

WOODEN TIES.

Wooden ties, life six years, 2 feet apart.

2,640 per mile, 5 renewals, or 13,200, at 80 cts. $10,560, for three miles	$31,680.00
Labor, $2,496 per year, for 30 years	74,886.00
Spikes, $171, for 3 renewals	513.00
Total	$107,079.00
Cr. old spikes ⅔	342.00
Total	$106,737.00

THE DIFFERENCE.

Cost of wooden ties	$106,731.00
Cost of steel ties	52,263.50
Total cr. dif. to met. system	$54,467.50

Or equivalent difference of $8.60 each for metallic ties, or equivalent to paying $4.13 each for wooden ties.

Counting $54,467 for 30 years, equals $1,815.58 per year; divided by 3 (miles) gives $605.19 per mile profit; $605.19 is equal to 3 per cent. on $20,000 capital per year per mile of road.

The Preservation of Iron.

John Heald, the proprietor of the machine works at Crockett, Contra Costa county, Cal., has for some years been experimenting with a view to preserving exposed iron-work, and has demonstrated some things respecting this important matter that may be of great value. Mr. Heal, some years ago, had occasion to move a gas holder at Vallejo, and happened to notice on the old plates, which were badly corroded, that the "shipping marks" on the sheets were perfectly preserved. This led to the examination of other cases of the kind, where marking had been done on the iron-work, and also to experimenting with turpentine and white lead as a fire coating to prevent rust. It is found that when surfaces are coated with finely ground lead, thinned with spirits of turpentine, no corrosive action or scaling takes place, even when heavy coats of paint are afterwards put on the outside. Mr. Heald says that common paint mixed with oil is too thick to penetrate or close the imperfections of the surface, and penetrate beneath the scale where it exists, thus leaving places for corrosions to begin beneath the paint. With turpentine and white lead mixed thin, the very pores of the iron are closed. The interstices, to so call them, are too minute to receive the body which oil gives, but are closed by the thinner compound. This is the theory, but that is a matter of no consequence, so long as the fact is known. —[San Francisco Industry.

JUST about fifty years ago stoves—cooking and heating stoves—first began to be generally used. That was when Americans began to make stoves for the home market.

Industrial Notes

Blast Furnaces:—

Mr. Robert H. Coleman has decided to at once erect another new furnace at Colebrook, Pa.

Macungie (Pa.) Furnace, which has been undergoing repairs since July 1, is about completed, but will remain idle subject to a more favorable market.

The blast furnace of Isaac McHose & Son, at Norristown, Pa., chilled on Monday, the 24th ult., and was blown out. It will be repaired and relined and put in operation again as soon as possible.

The Millerton charcoal furnace, at Irondale, N. Y., blew out on Thanksgiving day, its resumption depending on future developments in the iron trade. In the meantime a new hearth will be put in and general repairs made.

James P. Witherow, of Witherow's Works, this city, on December 27, closed a contract for the building of a large blast furnace in Roanoke, Va. This is the second one Mr. Witherow has put up in Roanoke for the same company. The company is composed largely of New York and Philadelphia capitalists, the principal of them being Samuel Crozier, of Philadelphia. The furnace will cost about $125,000. Mr. Witherow has built a large number of furnaces throughout the South within the last few years, and speaks very encouragingly for progress and developement of that section.—[New Castle (Pa.) Guardian.

We mentioned a couple of weeks ago that the indications were that the Wellston Furnace would be bought and put in blast before very long. We are pleased to chronicle this week the fact that the deal has gone through, the furnace has been purchased by a company to be known as the Wellston Furnace Co., composed of Messrs. J. C. Clutts and T. J. Morgan, both well-known business men of this place, and Hyde, Forsythe & Co., pig iron merchants of Chicago. The consideration paid for the furnace and all the yards and grounds surrounding it, consisting of about thirteen acres, together with all the buildings thereon, was $36,000. Work has been commenced at repairing one of the stacks and it will be put in blast sometime in January.—[Wellston (O.) Argus.

All the furnaces in the Birmingham district are doing an immense shipping business, and all are hampered by the lack of cars. Eighteen months ago there was no regular Eastern pig iron business from Birmingham. On the other hand the East was used as a dumping ground for iron that could not be disposed of in the regular Western markets. Now there is a constant and legitimate trade with Baltimore, New York and other Eastern seaport and interior cities. About one-half the iron from the Birmingham furnaces now goes to points North of the Ohio River, East of the Mississippi and West of Pennsylvania; about one-sixth goes to Eastern cities in direct competition with the Pennsylvania and foreign pig, while the remainder goes to St. Louis, Kansas City and other trans-Mississippi points.—[Birmingham Age-Herald.

It is reported that Frank A. Blair and others, of Perry county, O., have leased the Ironton furnace, of Buffalo, which is expected to be blown about April 1st, and which will give employment to about 200 men. Buffalo alone uses enough iron to keep at least one blast furnace running. The fact that the blast furnace is leased by men who are engaged in the same business in Ohio, where coal and iron are at their doors, is proof that Buffalo is a good point for the manufacture of iron. Then, too, the fact that a large amount of ore has been handled here this year, with promise of a constantly increasing amount, shows conclusively that furnaces which must be reached by rail from here are not so conveniently situated as are these in thi city. "Buffalo is a natural market for iron," declares a man interested in the iron trade, "and the increased facilities for obtaining coal and coke were an important factor in bringing the Blairs here."—[Financial Record, New York.

Rolling Mills:—

The Montreal Rolling Mill Company, Montreal, Can., have decided to enlarge and improve their mills.

The brick rod mill, new rod mill, new blooming mill, 9-in. mill, 12-in. mill and small hammer, of the Cleveland Rolling Mill Co., started up last Monday morning.

The Edge Moor Iron Co, of Edge Moor, Del., has transfered to the Edge Moor Bridge Works, of Edge Moor, that branch of the company's business embracing the building of iron and steel bridges, viaducts, elevated railways, marine piers, iron and steel structural work for buildings and roofs, and the manufacture of wrought-iron turn tables, steel eyebars, upset rods, sleeve-nuts and clevises. The transfer includes the shops and entire plant heretofore used by the company in the manufacture of the above-mentioned product.

A press dispatch from Steubenville, O., under date of the 26th ult., says: "James F. Daton, receiver of the old Mingo Iron Works, which failed in 1879 with a large indebtedness, to-day declared the second dividend to the creditors. There were claims amounting to $286,000 presented to the receiver, the heaviest one being by Singer, Nimick & Co. Upon this amount the receiver has declared a dividend of 1 46 100 per cent. This is all the creditors will ever receive, as the settlement of to-day is final. The receiver has been discharged."

On Friday, the 21st ult., work was commenced on the erection of a large wire rod mill, at New Castle, Pa. The capital stock of the new company is $150,000, all of which, it is stated, has been p ssed in. The prop osed buildings will cover four acres of ground, just east of the Crawford furnace, and will turn out about 150 tons of rods per day. President William Patterson, of the National Bank, of Lawrence County, and other capitalists of New Castle and Pittsburgh, are interested in the new concern.

Steel Works:—

The Waugh Steel Works, of Belleville, Ill., are manufacturing steel rails, billets, slabs and nails. The company have also recently commenced the manufacture of steel shafting of all the different sizes, besides squares and flats.

The Joliet Steel Company, of Joliet, Ill., has received an order from the Fort Worth & Rio Grande road, said to be for 5,000 tons of steel rails. It is also reported that the Edgar Thomson Steel Works, of Pittsburgh, have a similar contract.

Machine Shops and Foundries:—

Guil & Bumiller will build a machine shop on Willow street, Chicago, Ill.

A new foundry is being erected at McKeesport, Pa., by George Russes, E. H. Leezure and others, and will soon be ready for operation.

The Crescent Foundry Company, Limited, have been organized at Pittsburgh, with a capital stock of $5,000. The company is composed of Louis Weitheimer, Jacob J. Kish, William C. Kish and Louis M. Kish.

The Collins-Gibbons Mfg. Company, of St. Louis, purpose at an early date to put in the necessary machinery and increase their force sufficiently to make four sizes of their automatic wire straighteners and cutters.

The River Machine Company, Messrs. Teare, Wight & Co., Cleveland, will erect a new boiler shop in addition to their present works, the increase of business requiring a larger plant and more facilities to meet the requirements of trade.—[Marine Record.

William Tod & Co. have just completed a new brick tool room and stock house, and started two new lathes and a 60 inch Sellers planer. They are also building for their own use, a hydraulic press with 10-inch ram, and a very heavy pit lathe for boring and turning large wheels.—[Youngstown (O.) Telegram.

Incorporated: Colby Gas Regulating Company, Chicago; capital, $150,000; to manufacture machinery; incorporators, E. J. Colby, F. F. Reed and T. B. Dyche.—American Feed Water & Purifier Company, Chicago; capital, $100,000; for manufacturing; incorporators, J. T. Revell, N. L. Bancroft and D. J. Revell.

W. P. Davis, North Bloomfield, N. J., well known to our readers as a manfuacturer of key-setting machines and other specialties, will extend the scope of his business by opening offices at 169 and 171 Mill street, Rochester, N. Y., where he will handle a full line of machine tools and supplies; also engines and boilers.

The James E. Thomas Company, founders, of Newark, O., cast recently the fourth of a number of large band-wheels they are making for Corliss engines. Its dimensions were: Diameter, 16 feet; bore, 10 inches; rim, 36x4½ inches. Its weight was 29,400 pounds. It was cast in one piece, and afterward cut in two for shipment, being provided with lugs for bolting together again.

Perkins & Co., of Grand Rapids, Mich., are building a fine addition to their shops, 75 by 90 feet, three stories high. Their machine shop, which is built entirely of the beautiful cream-colored brick so prominent in Grand Rapids architecture, now measures 220x75 feet. Their foundry is 60 by 40 feet. Nine different styles of single machines are made by them, embracing over forty patented movements and devices.

The annual election of the Lloyd Booth Company was held yesterday, resulting as follows: President, Lloyd Booth; Vice President, H. M. Garlick; Treasurer, C. H. Booth; C. W. Bray, Secretary. This company's works are rushed with business at present. Last week orders were received for the building of new rolling mills at New Albany, Ind., Roanoke, Va. and Duluth, Minn., and one for a shears weighing 50,000 pounds from the Andrews Brothers Company.—[Youngstown (O.) Telegram.

The Vulcan Iron Works, of No. 86 North Clinton street, Chicago, have been given the contract for eighteen steel shafts and crank shafts for the United States Monitor Menadnock, now in process of reconstruction in San Francisco, Cal. The United States Navy Department accepted their bid of $7,290. They have also an order for a Rotary steam snow plow, for railroad work, fitted with Caldwell's patent auger, for Minneapolis parties. This machine is to be the largest of its kind yet made, having three double engines, with cylinders, eighteen inches long, sixteen inches stroke, and a locomotive boiler, with 1,500 square feet of heating surface. The car will be made of structural iron, and the trucks of especially heavy design. The entire car is calculated to weigh 55 tons.

Hardware:—

The Galvin Brass & Iron Company, Detroit, will build a foundry for the purpose of manufacturing hardware specialties.

The Favorite Stove Works, employing 300 men, has closed at Cincinnati, for the purpose of removing its entire plant to Piqua, O. This change of position is made because of larger grounds, cheaper fuel, which is natural gas, lower taxes and cheaper rent for workmen.

On Monday, the 24th ult., the Pottstown Iron Company, of Pottstown, Pa., closed down the nail department of their plant, and paid off and discharged all the employes. The average time made during the past month, has been about ten days.

Fires in Iron Works:—

At East Liverpool, O., A. J. Boyce's machine shop was destroyed by fire. The loss is $25,000; insurance $6,000 to $10,000.

At Chesley, Ont., Dec. 27, fire broke out in Blair Bros. fanning mill factory, resulting in the complete loss of both building and contents. Loss about $1,500. Stock insured for $1,000.

Miscellaneous:—

At Buffalo, N. Y., the American Steel Barge Company on January 3, filed a certificate of incorporation. The capital stock is $500,000.

Col. Young, formerly with Hussey, Howe & Co., Pittsburgh, is at the head of the company that bought out the Bolton Iron Works, of Canton, O.

Incorporated: Peoria Pump & Implement Company, Peoria; capital, $30,000; incorporators, James M. Rice, Joshua M. Frazier and William B. Harris.

The Fulton Iron Works, Detroit, have sold nearly a thousand of their sure grip steel tackle blocks in the first three months since the issue of the patent.

The new steel steamer, Northern Wave, which was launched in Cleveland last week, is the fifth of its kind built by the Globe Iron Works for the Northern Steamship Co. She measures 292 feet keel, 312 feet over all, 40 feet beam, 24 feet 6 inches molded hold, and cost $220,000.

The United States Iron and Tinplate Company, Limited, of Demmler Station, Pa., are contemplating the completion of a small new addition to their works. The building was commenced about a year ago, but was not finished on account of the uncertainty of the tariff laws.

There is now some prospect that the Warren (O.) Tube Works will be sold soon. Last week Messrs. John O. Hart, J. B. Graham and S. A. Corbin appraised the plant at $89,000, which allows of its being sold for $60,000. The first appraisement was $115,000 and the works could not be sold for the two-thirds of that amount.

Sealed proposals will be received at the Office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 26th day of January, 1889, for the labor and materials required in the erection and completion of the low-pressure return-circulation steam heating and ventilating apparatus for the U. S. Court House and Postoffice at Fort Smith Ark.

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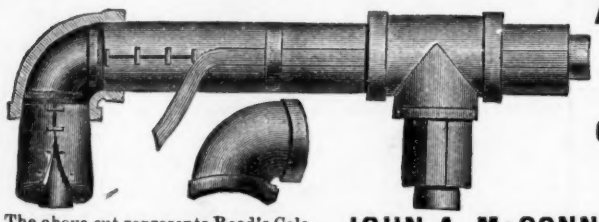

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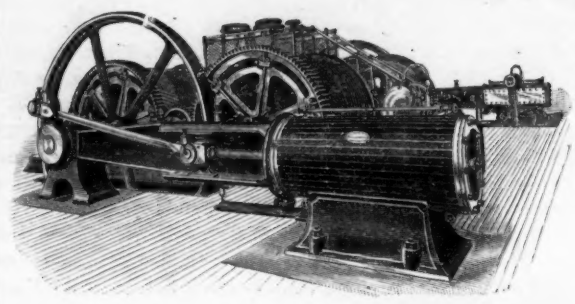

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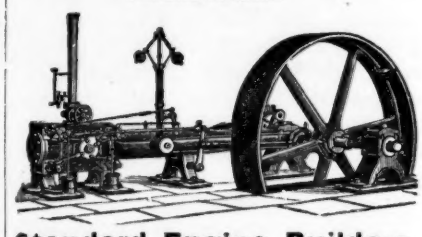

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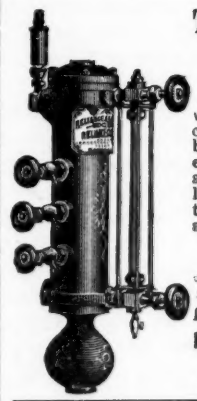

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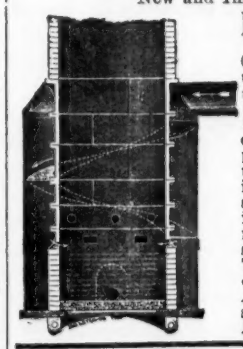

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For holding drills and reamers for lathe work. Prevents breaking or slipping. Can also be used for drilling and reaming holes by hand, and for reaming holes under drill presses, etc. Five holders in a set. Made with double handle, when required
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MARKET REVIEW.

OFFICE OF IRON TRADE REVIEW.

CLEVELAND, O., WEDNESDAY EVENING, January 9, 1889.

Iron Ore.

The situation can best be described as one of waiting. The ore men do not seem to be very anxious to sell in the face of a declining pig iron market, while the furnacemen are anything but anxious to purchase, in view of the present uncertainty of the situation. While it is true that the consumption of pig metal is still continued at a very large rate, it cannot be denied that the recent falling off in sales has had a very depressing effect all around, but a change for the better is hoped for by the end of the month. Ore dealers, at least, look forward to the first of February with the anticipation of such an improvement in the condition of things that will enable them to enter the market with some confidence, and secure some sort of hearing from their customers. It does not take much to make the furnace interests feel uneasy, and with the present lowering and weakening of prices, together with the largely diminished demand, there are few pig iron men who feel like buying ore. On the other hand, ore men, having at stake the opening quotations, which may seriously affect the prices throughout the season, do not want to force a market for fear of hurting themselves, and the result, as above indicated, is a situation of waiting. Lake freights, which, a little while ago, were expected to be quite firm during the coming season, may now be reasonably expected to be only moderately strong, and in view of the length that is predicted for the '89 season, ruling prices will be about $1 from Escanaba, $1.15 from Marquette, and $1.40 from head of Lake Superior.

Pig Iron.

Little is to be reported this week, except the continuance of the dull market, both as to sales and prices, and a very small demand, confined to daily consumption. This is in a measure explained by the fact that iron men generally, desiring to make as good a showing as possible for the year, permit their stocks to run very low prior to the taking of inventories, and since there has been hardly any time for this work, the resumption of active operations may hardly be expected before the first of next month. The railway equipment and agricultural interests, which are usually large buyers during the month of December, have not entered the market yet, so that it may be fairly expected that when business does open, it will do so with a rush. It is agreed on all hands that the present weakness in the iron market is but temporary, and that a firmer feeling and a corresponding advance is a matter of but a very few weeks. We continue to quote, f. o. b. cars, Cleveland, four months:

No. 1 Bessemer	$18 70@19 20
No. 1 foundry	18 20@19 70
No. 2 foundry	17 20@17 70
No. 1 gray forge, red short	16 70@17 20
No. 2 gray forge, neutral	16 20@16 70
No. 1 American Scotch	18 20@18 70
No. 2 American Scotch	17 20@17 70

Manufactured Iron.

The business is practically at a standstill, no movement seeming to take place in any of its important branches. There appears to be but little inquiry either as to bars or sheets, and nothing has occurred to resuscitate the rail market from its dormant position. Makers of building shapes and regular channels complain of the falling off in orders, but hope for an improvement within the month.

Scrap Iron.

While the better grades of scrap iron nominally maintain their quotations, no sales have recently taken place by which prices may be established, beyond the offer of holders and in the absence of any bid.

Hardware.

The market is very quiet, jobbers being largely occupied with their inventories. Lead is steady, copper dull, and tin shows a tendency to advance.

DETROIT PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by William F. Jarvis & Co.

The active demand which was so confidently expected on the opening of the new year, has not been fully realized. While sellers are not trying to force sales, yet the fact of one sale of 10,000 tons of Southern Gray Forge, for delivery running through 1889, having been made at a very low figure, has given buyers the impression that prices on coke irons will not advance as has been generally predicted, and that a lower level is as likely to be reached. Considerable inquiry for Lake Superior charcoal is being made, and some orders for round lots have been taken for delivery during the next three or four months. While the market is not buoyant, yet on most grades prices are still held firm, and we quote as follows (Jan. 7):

Lake Superior Charcoal, all numbers, $20 00@$20 50; Lake Superior Coke, all ore, $19 75@$20 25; Lake Superior coke, cinder mixed, $18 00@$18 50; Standard Ohio Blackband, $19 75@$20 25; Southern No. 1, $17 75@$18 25; Southern Gray Forge, $15 25@$16 25; Southern Silvery, $17 00@$17 50; Jackson County (Ohio) Silvery, $18 50@$19 00; Old Wheels, $20 25@$20 75.

CINCINNATI PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Rogers, Brown & Co.

The market is fairly active, but at a lower range of prices. A number of sizable orders placed this week revealed the fact that there is a pressure to sell, and that sharp competition between the furnaces both North and South has driven prices down materially. The tone of the market is weak, and buyers who expected to take hold freely in January are waiting further developments. The blowing of new furnaces, and resuscitation of old plants long idle, points to an over supply unless the rate of consumption materially increases. We quote for cash, f. o. b., Cincinnati (Jan. 5):

HOT BLAST FOUNDRY.—Ohio and Southern Coke, No. 1, $15 75@$16 00; Ohio and Southern Coke, No. 2, $15 00@$15 50; Ohio and Southern Coke, No. 3, $14 25@$14 75; Ohio Soft Stonecoal No. 1, $16 50@$17 00; Ohio Soft Stonecoal No. 2, $15 50@$16 00; Mahoning and Shenango Valley, $17 00@$18 00. CHARCOAL IRON.—Hanging Rock Charcoal No. 1, $21 00@$22 50; Hanging Rock Charcoal No. 2, $19 00@$22 50; Tennessee and Alabama Charcoal No. 1, $18 00@$18 50; Tennessee and Alabama Charcoal No. 2, $17 00@$18 00. FORGE—Strong Neutral Coke, $14 00@$14 25; Mottled Neutral Coke, $13 00@$13 25; Cold Short Coke, $13 25@$13 50. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $20 00@25 00; Hanging Rock Cold Blast, $22 00@$25 00; Lake Superior Malleable & Car Wheel, $22 00@$23 00.

CHICAGO PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Rogers, Brown & Co., W. W. Backman, Resident Agent.

There is more movement in iron as the New Year opens but no improvement in prices; indeed, the tendency is still slightly downward. Figures are already so low that furnacemen claim that with increasing cost their margins are likely to be on the wrong side. Lake Superior charcoal irons, particularly car wheel grades, continue firm, and in view of scant supply and heavy demand are likely to advance. We quote for cash, f. o. b. Chicago (Jan. 5):

Coke and Bituminous Coal Foundry:—Ohio (Hanging Rock softeners), $18 50@19 00; Ohio (Black Band softeners), $18 50@19 00; Ohio (Jackson county softeners), $18 60@00 00; Lake Ore and Cinder, $17 25@17 75; Southern coke foundry No. 1, $17 25@17 75; Southern coke foundry No. 2, $16 25@16 75; Southern coke foundry No. 3, $16 25@16 50. Southern Coke Softeners, No. 1, $16 25@16 75; Southern, No. 2, $15 75@16 25; Charcoal Foundry:—Lake Superior, No. 1 and 2, $20 00@00 00; Southern, $19 50@20 50; Hanging Rock, $21 00@23 50. Car Wheel and Malleable:—Standard Southern, $21 50@26 25; Hanging Rock Cold Blast, $24 50@27 00; Hanging Rock Warm Blast, $22 50@24 50; Lake Superior, Nos. 3 to 6, $20 50@21 50.

LOUISVILLE PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Geo. H. Hull & Co.

The tendency of the market has been downward, and sales have been made at prices that we did not believe possible a short time ago. The trouble does not lie so much among buyers as representatives of outside furnaces. The present prices were not asked nor expected, but were brought about by one furnace representative shading the market, followed by cutting by others, until buyers became demoralized and did not know what to expect. We quote as follows (Jan. 7):

Southern Coke, No. 1, foundry, (new classification) $15 50@$16 00; Southern Coke, No. 2, Foundry, (new classification) $15 00@$15 50; Southern Coke, No. 3, Foundry, (new classification) $14 50@$15 00; Grey Forge, $14 00@$14 50; White and Mottled different grades, $13 50@$14 00; Silver Grey, different grades, $13 75@$14 50; Southern Charcoal No. 1 Foundry, $16 50@$17 00; Southern Charcoal, No. 1, Mill, $15 25@$15 75; Southern Car Wheel, Standard brands, $22 50@$23 50; Southern Car Wheel, other brands, $18 50@$20 00; Hanging Rock Coke, No. 1, Foundry, $16 00@$16 50; Hanging Rock Charcoal, No. 1, Foundry, $20 00@$21 50; Hanging Rock, Cold Blast, $21 25@$24 50; Hanging Rock, Warm Blast, $00 00@$00 00.

ST. LOUIS PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Rogers, Brown & Co.

Considerable business has been transacted since last report, but it has run mostly to specialties. The car builders are supplying their wants to cover heavy contracts for rolling stock, and they find very light stocks of car wheel grades to draw from. Both Ohio irons and Southern irons rule lower. Some of the largest consumers are deferring purchases, believing the future of the market to be in their favor. We quote (Jan. 5):

Hot Blast Foundry—Southern Coke, No. 1, $16 75@$17.75; Southern Coke, No. 2, $16.00@$17.00; Southern Coke, No. 3, $15 50@$16.50; Southern Charcoal, No. 1, $18.00@$19.00; Southern Charcoal, No. 2, $17.50@$18.50; Missouri Charcoal, No. 1, $17.50@$18.50; Missouri Charcoal, No. 2, $17.00@$18.00; Ohio Softeners, $17 00@21 00. Forge.—Mottled, $14.00@$15.50; Missouri, $15.50@$16.50.—Car Wheel and Malleable Irons.—Lake Superior, $20 00@23 00; Southern, $20 00@24 00; Connellsville Coke, East St. Louis, $4 70; St. Louis, $4 85.

CHATTANOOGA PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Lowe & Tucker.

There is but little to add to the general tone of the pig iron trade beyond the reports for the past few weeks, while the prospects for the future in general business is very flattering, there has not been sufficient time since the first of the year to give much impetus in trade matters, and everything may be denominated quiet under the influence of the dullness that has prevailed for the last few weeks. Prices have receded a little on small orders, but on large contracts for deliveries during the year we fail to see any dropping off in prices. The furnaces, as a general thing, are of the opinion that prices will be higher and demand greater as the year advances, and that there will be full requirements for all that is made.

Protesting Against Increased Rates.

Friday, the Mahoning Valley Manufacturers' Association, of this city, sent a request to the freight agents of the Pittsburgh railroads for a conference yesterday at the Monongahela House, to confer in regard to the new freight tariff which is announced to go into effect on the 14th inst. The request was granted and Messrs. J. G. Butler, Jr., J. H. Sheadle, H. B. Shields, Robert Bentley, H. O. Bonnell and M. C. Wick went down yesterday to represent the Manufacturers' Assocciation. A *Telegram* representative asked Mr. Bentley last evening what the result of the conference was, and he replied:

"We presented our protest to the freight agents against the proposed increase, showing why higher freight rates would be oppressive to iron manufacturers. The representatives of the different railroads listened to our statements and said they would present them to their superiors for decision. A reply is expected from them during the week."

A Pittsburgh paper expresses the opinion that a compromise will be effected between the railroad companies and the manufacturers.—[Youngstown (O.) Telegram.

Piston Explosions.

Glasgow Engineer.

The piston of a steam engine is not at first sight a likely part to give way through explosion. But there are cases on record where hollow pistons, on being heated for removal from the rod, have unexpectedly exploded. Such explosions of hollow cast-iron pistons have recently been the subject of special attention in France, the fact appearing that no less than five such explosions have occurred in French workshops during the last 20 years in re-heating these pistons. In examining into the interior of a piston that had been in use for 11 years, there was shown the existence of a brown substance containing fatty matter, oxide of iron, peroxide of iron, and carbon. From this it was supposed that a certain quanity of water had been forced into the cavity in service, either through the iron or through the imperfection in the plugs with which the original core support cavities were filled. This water, in forming oxide of iron, set free its hydrogen, which filled the piston cavity, and as the recombination of this hydrogen with the oxygen at a low red heat would have the effect of producing such an explosion, the suggestion is made that this result may be prevented if all such pistons be tapped before re-heating.

THE Nordyke & Marmon Company, of Indianapolis, Ind., is filling an order for a small flour-mill, ordered by an Englishman. It is to be located at the gold fields near Natal, South Africa. It will be driven by an immense American windmill, that being the only available power in that far-away clime, and will be shipped via New York, Liverpool and Cape Horn to Natal, and then by wagon for about 300 miles to destination.

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Relating to the Mechanic Arts, Which Become Public Property January 23, 1889.

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Nicholson..... .....60&5@60&10
Black Diamond.....60&10
Royal.....75
Heller's horse shoe rasp.....dis 50&7½@50&10

Faucets.

Frary's Patent Petroleum.....dis 40&5&2
First Quality, Cork Lined .....7 &5@70&10
Self-measuring, Enterprise, per doz $36 dis 20&10

Fly Traps.

Paragon.....₱ doz $1.75

Forks

Hay, Manure and Spading. list.....dis 65&5

Fruit and Jelly Presses.

Enterprise Mfg. Co..... .. dis 20&10@30

Fry Pr

Central Stamping Co.'s list.....dis 75

No	0	1	2	3	4	5	6	7	8
₱ doz.	$3 00	3 75	4 25	4 75	5 25	6 00	7 00	8 00	9 00

Fluting Scissors.

Discount 45

Fluting Machines

Eagle 3¼-inch.....$2.15, dis 35
Geneva Hand Fluter. White Metal.. ₱ doz. 12.00.....dis 25
Shepard hand. Nos. 85 $15.30. 95 $8. 110 $11 dis 40
Knox, 4½ inch rolls.....$3 25 each / Knox. 6 inch rolls .....$3 60 each } dis 35
Crown, 4¾ in. $3 50; 6-in. $4 00; 8-in. $6 50 each .....dis 35
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Gauges.

Marking .....dis 60&10
Wire.....dis 10&10

Gimlets.

Nail and Spike.....dis 50&10&5
Double Cut. low list.....2
" Bee".....₱ gross $12, dis 2@25&5

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Tin enamele d.....dis 40&5@40&10
Family, Handy ..... dis 50

Grindstone Fixtures.

Sargent's..... dis70&10

Gun Wads.

U. M. C. & W. R. A.—B. E., 11up...2 00 / U. M. C. & W. R. A —B. E., 9&10...2 30 / U. M. C. & W. R. A.—B. E., 7&8.... 2 60 / U. M. C. & W. R. A.—P. E., 11up... 3 10 / U. M. C. & W. R. A.—P. E., 9&10... 4 00 / U. M. C. & W. R. A.—P. E., 7&8.... 4 90 } dis 20&
Eley's B. E., 11 up.....1 75
Eley's P. E., 11@20.....2 80

Hack Saws.

Griffin's Hack Saws, complete.....dis 40&10@5
Griffin's Hack Saw, Blades only.....dis 40&10@5
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Halters.

Jute horse and cattle ties.....$13.50 gro. net

Hammers.

Maydole s.....discount 25@25&10
Atha new list, Jan 15.1887.....dis40&10@5
Magnetic Tack, No. 1, 2, 3, $1.25, $1.50 and $1.75 dis 30&1
Heavy hammers and sledges under 5 lbs.36c.ove 5lbs, 30 c ..... dis 70&10@70

Hand Cuffs and Leg Irons.

Providence Tool Co., hand cuffs, $15 ₱ doz...dis 1
Providence Tool Co., leg irons $25 ₱ doz.....dis 1
Tower's .....dis 25

Handles—

Door or Thumb Latches.

Per doz Nos.	0	1	2	3	4	
Sargent's	.90	1 00	1 18	1 35	1 50	dis 60&10

Roggin's Latches.....₱ doz. 30@35c
Bronze Iron Drop Latches.....₱ doz. 70c net
Jap'd store door handles—Nuts. $1 62; Plate $1 10; no plate $0 88.....net
Barn door.....₱ doz $1 40, dis 0&10
Wrought chest.....dis 50&10&10
Surface chest.....dis 70
Flush chest.....dis 70
Liftins .....dis 70
Saw and plane .....dis40&10
Hammer and hatchet.....dis 25&5&2
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Apple firmer chisel, assorted .....₱ gros $5 00
Apple firmer chisel, large.....₱ gross $6 00
Socket firmer chisel, assorted.....₱ gross $3 00
Socket framing chisel, assort .....₱ gross $5 00
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Richards.....dis 20&10&10

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Covert, New Patent, new list.....dis 50&5&2

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Lightning.....per doz. $8 00 dis 25
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Screw, hook and strap, 8 10 12 in..... 3¾@4
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Gate, western.....₱ doz $4 40, dis 55
Gate, N. E.....₱ doz $7 00, dis 55
Gate, N. E. reversible.....₱ doz $5 20, dis 55&15
Gate, Clark's. Nos. 1. 2. 3.....dis60&10&5
Gate. N. Y. State .....₱ doz $5 00, dis 55&15
Gate, automatic .....₱ doz $12 50, dis 50
Gate, common sense.....₱ doz pair $4 50, dis 50
Gate, Shepard's .....dis 60&10&5

Hollow-Ware.

Stove Hollow-Ware. Ground dis.....60&5@60&10
" " Undground ...60&10&10@70
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Saucepans .....dis 40@40&6

Galvanized Tea-Kettles

Inch	6	7	8	9
Each	.55	60	65	75

Hoes.

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Hog Rings and Ringers.

Hill's rings .....$2 25@$2 40
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Hooks.

Bird Cage, Sargent's list.....dis 60&10&10
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Hooks and Eyes—Brass.....dis 60&10&10

Horse Nails.

No.	10	9	8	7	6	
Ausable. ₱ lb	.23	24	25	26	28	dis25&10to25&10&10
Putnam, ₱ lb	19	20	21	22	24	...dis5&10&2½&2½

Essex..... 2½&10&2½&10&10

Burden.....₱ keg $4.25
R. I. Horse Shoe Co., Perkins' Imp. at factory.....₱ keg $4 25
Mule Shoes, at factory.....₱ keg $5.25

Hose, Rubber, Boston Belting Co's.

Standard .....70@70&10
Extra..... 60@ 0 &10
Best.....45&10

Ice Picks, Chisels, &c.

Am. Ice Chisel Pol'd.....₱ doz. $3.00, dis20

Ice Cream Freezers.

American.....50&10
Gem..... 55&10
Crown..... 50&10

Ice Tongs.

Champion .....₱ doz $4.00, dis 25&10
Family.....₱ doz $2.75, dis 20@25

Jack Screws.

Illinois Bolt Co. list.....dis 70

Kettles.

Brass. 7 to 17 inches inclusive.....₱ lb 22c. net.
Brass larger than 17 inches.....₱ lb 24c.
Enameled and Tea Kettles.....See Hollow Ware

Keys.

Eagle, cabinet, trunk and padlock.....dis 33⅓&2

Knives.

Russell's Butcher.....net
Moran's Shoe Knives..... dis 20

Knobs.

Carriage, Japanned.....₱ gross 80c. dis 60&10
Base, Rubber Tip.....dis 70&10&5
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Door Por. Jap'd.....75c&75c
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Tubular, Lift Wire. No. 1. ₱ doz 7 00
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Lever bell pulls, genuine bronze.....dis 60&10
Butts, genuine bronze.....dis 60&10
Butts, bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges & flaps genuine bronze....dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze .....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull genuine bronze.....dis 66⅔
Letter box plates, genuine bronze.....dis 60&10
Barn door locks .....dis 33⅓

Lemon Squeezers.

Porcelain lined.....₱ doz $6 00, dis 25&30
Wood.....₱ doz $3 00, dis 3[illegible]
The "Boss".....₱ doz $2.50
Dean's No. 1, ₱ doz $6 50; 2, $3 25; 3, $1 90....dis
Little giant.....dis 50@10&5

Lines.

Cotton Chalk.....dis 55
Silver Lake, Braided, No. 0, $6.00; No. 1, $6.50; No. 2, $7.00; No. 3, $7.50 ₱ gross .....dis 25
Masons' Linen.....dis 45
Wire Clothes, No 18, $3.00; No 19, $3.00; No. 20 $2.50;.....

Mallets.

Hickory .....dis 20&10@20&10&10
Lignumvitæ.....dis 20&10@20&10&10
Penfield Block Co., Lignumvitæ and la Hickory.....dis 30@30&10

Mattocks.

Regular list.....dis 60&10@60&10&10

Meat Cutters.

Dixon's (P.S.&W.)	1	2	3	4	
	₱ doz. $14.00	$17.00	$19.00	$30.00	dis 45
Draw Cut Nos.	5	2	6	8	10
Each.....	$50.00	$75.00	$80.00	$225.00	400.00

dis 20@25

Woodruff's (P S & W) per doz No 100 $15 No 150 $18dis 40

Hale's—Nos. 11 12 13 $27 $33 $45 dis 70@70&5

Enterprise.....dis 30

Mincing Knives.

Am. (2d quality), ₱ gro, 1 blade, $7; 2 blades, $12; 3 blades, $18.....net
Smith's, ₱ doz. single, $2 00; double, $3 00 dis 40@45

Money Drawers.

Tucker's ₱ doz.....$18 @20

Molasses Gates.

Stebbins' pat .....dis 70@70&7½
Stebbins' genuine.....dis 60&10&10
Stebbins' tinned ends.....dis 40&10
Lincoln's pattern.....dis 70@70&10
Scoville.....$7 45&10

Nails (wire).

List July 14, 1887.....dis 70&10
Standard Penny Nails, ₱ keg card rate { Car lots.....$2 55 / Less than car lots, $2 65

Nuts and Washers.

Size of bolt in.....	¼	5-16	⅜	½	⅝	¾	1
Square.....	8¾	7	5½	4¼	4	3¾	3½
Hexagon.....	15½	11½	8½	6	5¾	5¼	5
Washers.....	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₱ lb add ½c, 1lb boxes add 1c to list

Nut Crackers.

Table (Humason & Beckley Mfg. Co.).....dis 40
Blake's pattern.....₱ doz. $2 00, dis 10
Quakenbush.....$5 00 net

Oakum.

Government.....₱ lb 8 c
U. S. Navy.....₱ lb 7 c
Navy .....₱ lb 6½c

Oilers.

Zinc and Tin.....dis 65@65&10
Brass and Copper.....dis 50&10@50&10&5
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₱ doz.....dis 10@ 10&10

Packing, Steam.

Boston Belting Co .....dis 60
American Packing.....10@11c
Russia Packing.....14c
Italian Packing.....1 @14c

Pencils.

Faber's Carpenters'.....high list, dis 50
Faber's Round Gilt.....₱ gro $5.25 net

Picks.

Railroad, 5 to 6 lbs.....$12 dis 60&10@60&10&5
" " 6 to 7 lbs.....$13 dis 60&10@60&10&5

Pinking Irons.

₱ doz .....65c. net

Picture Nails.

Brass head, Sargent's list..... } dis 50&10&10
Brass head, combination list.....dis 50&10
Porcelain head Sargent's list, dis.....50&10&10
Porcelain head, combination list.....dis 40&10

Plane Irons.

Sandusky Tool C .....dis 30

Pliers and Nippers.

Button's Patent .....dis 30&10@40
Hall's Pat. Compound Lever Cutting Nippers, No. 2, 5 in., $13.50; No. 4, 7 in., $21 00 ₱ Doz. .....dis 20&10@33⅓
Gas Pliers. .....dis 60
Humason & Beckley .....dis 50@50&10
P. S. & W. Tinners' Cutting Nippers add 6 per cent. dis 10

Plumbs and Levels.

Standard list.....dis 70&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Post Hole and Tree Augers.

Samson Post Hole Digger....₱ doz. $36.00, dis 25&5
Eureka Diggers.....₱ doz. $16.00 @ $17.00
Champion.....per doz $9.00
Vaughan's Hollow Tube Post Hole.....$12.00 dis40

Potato Parers.

White Mountain.....₱ doz $5.00@$5.50
Anchor Combination.....₱ doz $8.00
Hoosier .....₱ doz $13.50

Pruning Hooks and Shears.

Disston's Combined Pruning Hook and Saw ₱ doz $18.00.....dis 20&10
Disston's Pruning Hook.....₱ doz $12.00 dis 20&10
Pruning Shears .....₱ doz 3.75@$4.00 net

Pulleys.

Hot House ..... discount 60&10
Japanned Screw..... discount 60&10
Brass Screw.....discount 60&10
Japanned Side.....discount 66⅔&10
Japanned Clothes Line.....discount 60&10

Pumps.

Cistern, best makers.....dis 50@10&60
Pitcher spout, best makers...dis 60&10@60&10&10
Pitcher spout, cheaper goods... dis 70&5@70&10&5

Punches.

Saddlers' or Drive.....₱ doz. good quality, 60@65c
Bemis & Call Co.'s Cast Steel Drive.....dis 50&5
Bemis & Call Co.'s Springfield Socket.....dis 50&5
Solid Tinners.....₱ doz. $1.44, dis 55

Rails.

Sliding Door, Wrought Brass.....₱ lb 35c dis 15
Sliding Door, Iron, Painted... ₱ foot 4c dis 20&10

Rakes.

Cast Steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher..... $10 @£....dis 10
Rifle Razor.....$9 50 net

Rivets.

Iron, Thousand, list November 17...dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage, list November 17.....dis 50@50&7½
Copper .....dis 50@50&10

Rods.

Stair, Brass.....dis 25&2

Rollers.

Barn door, Sargent's list, ... dis 60&10&10
Acme (Anti-Friction).....dis 55

Rope.

Manilla, ½ inch and over.....13¾c
Sisal, ½ inch and over..... 11¾c

Rules.

Boxwood..... discount 80&10@80&10&10

Sad Iron.

From 4 to 10 lbs.....per 100 lbs $2.40 @ $2.55
Self-heating.....₱ doz $9 net
Self-Heating, Tailor's.....₱ doz $18 net
Mrs. Potts's Irons. .....dis 40@40&1
Enterprise Star Irons.....discount 40

Sash Weights.

Per ton $22

Saws.

Disston's Circular..... discount 45@45&5
Disston's hand panel, rip &c.....discount 25@25&5
W. M. & C., Champion Regular..per foot 2½@2⅝c
W. M. & C., " Thin Back..₱ ft 27@.30

Saw Frames.

White, Vermont.....₱ gross $6 00 @$10 00
Red, polished & varnished ₱ doz $1.50, ...dis 25

Saw Sets.

Aiken's Genuine.....$13.00, dis 50 &10
Morrill Saw Sets No. 1 $15.00; No. 3 and 4 $24.00 .....dis 40 &10@50

Scales.

Hatch, Counter, No. 171 .....₱ doz $21.00
Hatch, Tea, No. 161.....₱ doz $6.75@7 00
Chatillon's Grocers .....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882 dis 50&10@50&10&6

Scrapers.

Adjustable Box Scraper (S. R. & L. Co.) $6.50.....dis 30&10
Box, 1 Handle.....₱ doz $4.00, dis 10
Foot.....dis 50&10@60

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles dis 65&10
Stanley R. & L. Co.'s Black Handles.....dis 60&10
Sets Interchangeable.....₱ doz $18.00 dis 25

Screws.

Wood Screws—List Jan 27, 1885.

Flat head iron.....	dis 70	Extra 10 often given
Round head iron.....	dis 65	
Flat head brass.....	dis 65	
Round head brass.....	dis 60	
Flat head bronze	65	
Round head bronze.....	60	

Machine, flat head, iron.....dis 55
Machine, round head, iron 50
Bench and hand—
Bench, iron .....55&10@55&10&10
Bench, wood, beech, per dozen $2.25.....
Bench, wood, hickory.....20 & 10
Hand, wood.....25&10@25&10&10
Lag or coach.....dis 66⅔@70
Coach, patent gimlet point..... 66⅔@66⅔&5
Bed.....25&5
Hand rail, ...66⅔&10

Saw Tools.

Atkins' patent.....₱ doz sets $6 00

Shears.

American (Cast) Iron.....dis 75&10@75&10&5
Pruning .....See Pruning Hooks and Shears
Barnard's Lamp Trimmers.....₱ doz $3.75
Tinners'.....dis 20&2
Seymours List, Dec. 1881..... dis 60 &10&10&5
Seymours Tailor's Shears.....dis 33⅓

Scroll Saws.

Lester, complete, $10.00.....dis 25
Rogers, complete, $4.00. .....dis 25

Sheaves.

Sliding Door R. & E. list Dec 18, 1885... dis 55&2
Sliding Door, Patent Roller.....dis 60&10&2
Sliding Door, Pat'nt Roller, Hatfield's.....dis 70
Sliding Door, Corbin's Anti-Friction Dec. 18, 1885 dis 60&2

Ship Tools.

L. & I. J. White.....dis 20 & 5

Shovels and Tongs.

Iron Head.....60&10@60&10&5
Brass Head.....60&10&10

Sieves.

Metallic, new list.....dis 50&25&10
Flour sifters { Victor..... $2 00 / Hunter..... $2 25 / Comet..... $1 25

Slates.

School, by case..... dis 50&10

Spoke Shaves.

Iron.....dis 45
Wood .....dis 30

Spoke Trimmers.

Bonney's.....₱ doz $10.00 dis 50
Stearns'.....₱ doz $9.00 dis 20&10

Spoons.

Basting Spoons ..... dis 70&10
Britannia. .....dis 60
Rogers Bros. .....dis 50

Squares.

Steel and iron ..... } dis 70@10&80
Nickel plated..... }
Disston's try square and T bevels.....dis 45&70
Winterbottom's try and miter.....dis 30&10

Steelyards.

dis 40&10@50

Stocks and Dies.

Blacksmith's .....dis 3[illegible]&5
"Lightning" screw plate .....dis 2[illegible]&50

Stone.

Hindostan, No. 1, 3c; Axe, 3¾c; Slips 5c
Washita Stone .....No. 1, ₱ lb 15&16c
Turkey Oil Stone.....4 to 3 in.....₱ lb 40c
Turkey Slips.....$1.00@1.50
Washita Slips No 1.....₱ lb 30@32
Washita No 2 stone.....₱ lb 11@11c
Arkansas Stone 1.75

Stove Boards.

Zinc.....70
Oxidized.....45

Shovels and Spades.

Ames' list Nov 1 1885..... discount 20
Dennis.....5.50
Hussey & Binns, rail road 8.00

Stove Polish.

Joseph Dixon's.....₱ gross $6 00 dis 10
Gem .....₱ gross 4 50 dis 10
Gold medal.....₱ gross 6 00 dis 25
Rising Sun.....₱ gross $5 50 net
Dixon's plumbago .....₱ lb 8c. net

Trowels.

Lothrops' Brick and Plastering.....dis 25
Reed's Brick and Plastering..... dis 15
Disston's Brick and Plastering... dis 25@25&10
Brade's brick..... dis 25

Tacks, Brads, &c.

New List, September 1, 1882. & Supplement Jan-1, 1886.
American iron carpet tacks all kinds.. 80@80&5
Steel carpet tacks all kinds..... 85@80&5
Swedes Iron carpet tacks all kinds ..... 80@80&5
Swedes iron tacks..... 75& @75&10
Swedes iron Upholsterers' tacks..75&10@75&10&5
Tinned Swedes iron tacks.....75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks ....75&10 75&10&5
American iron cut tacks .....75@75&10
Copper tacks .....50&10
Copper finishing and trunk nails.....50&10
Cigar box nails .....50&10@50&10&5
Finishing nails. .....70&10@70&10&10
Hungarian nails and miners' tacks.....70&10@70 &10&10
Gimp and lace tacks.....75&10@75&10&5
" " " tinned.....75&10@75&10&5
Trunk and clout nails.....70&10@70&10&10
Tinned trunk and clout nails.....70&10@70&10&10
Basket nails .....70&10@70&10&10
Chair nails .....70&10@70&10&10
Common and patent brads.....70&10@70&10&10
Tinned capped trunk nails.....70&10@70&10&10

Tinware.

Stamped, Japaned & Pieced, list Jan. 20, 1887..... .....dis 70&10@70&10&5

Tobacco Cutters.

Enterprise Mfg. Co. (Champion).....dis 20&10@30

Traps.

Game, Newhouse.....dis 35@40&5
Victor.....60&10
Wood, mouse.....15c ₱ doz holes
Delusion, mouse.....₱ gross $18 00 dis 15

Trammel Lifters.

Wollensak's Patent..... dis 50

Twine.

	BC.	P.
No. 12, Flax Twine, ¼ and ½ lb Balls.....	21c	&29c
No. 18, " " ¼ and ½ "	18c	&28c
No. 36, " " ¼ and ½ "	16c	&27c
2-Ply Hemp, ¼ and ½ lb Balls (Spring Twine)	11½	
3-Ply " 1 lb Balls.....	12	&12½c
3-Ply " 1¼ lb Balls	11	&11¼

Cotton Wrapping, 5 Balls to lb..... .....15@16c

Vises.

Solid box.....60@60&10
Parker's.....discount 20@25
Prentiss..... " 20 &5@25
Stephen's..... " 25&30
Saw Filers, Wentworth's.....dis 20&10
Saw filers, Stearn's ..... 33⅓&10@33⅓ x10&10

Washer Cutters.

Smith's Patent .....₱ doz $12 00, dis 20&10&10
Johnson's.....₱ doz $11 00, dis 33⅓
Penny's.....₱ doz Pol. $14 00; Jap'd. $16 00, dis 55
Appleton's.....₱ doz $16 00, dis 60&10
Bonney's.....dis 30&10

Well Wheels.

8 in., $2.25; 10 in., $2.75; 12 in., $3.25

Wire. New List Jan. 18. 1884

Brass and Copper.....discount 20&25
Bright and annealed, Nos. 0 @18 ... dis 70&5@72½
" " Nos. 19 @ 26.....dis 72½@75
" " Nos. 27 @ 36 dis 75@75&10
Coppered Nos. 0 to 18, market list.....dis 65&10@70
Galvanized Nos. 0 to 18 " " dis 60&7½@65
Tinned market Nos. 0 to 18,..... dis 65
Cast steel .....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9..... dis 75
Annealed Grape, Nos. 10 to 14..... dis 75
Stubs Steel Wire regular.....$6 00 @lb dis 30

Wrenches.

Coe's genuine, cash in 10 days..... 55 & 3
Girard Standard.....discount 70&10
Agricultural.....discount 75&10
Mechanics' .....dis 55&10 & 3
Bemis & Call's Combination.....dis 35
Donohue's Engeneers'.....20&5

TINNERS' STOCK.

Tin.

Banca 24
Straits.....24
English 23½
Bar.....25

Spelter.

American, cash, ₱ lb.....

Charcoal Tin Plate.

IC 12x12 225 sheets..... $6 00@6 25
IX 14x20 112 sheets..... 7 25@7 50
IC 10x14 225 sheets.....₱ box 5 75@6 00
IC 20x28 112 sheets.....12 00@14 50
IX 10x14 225 sheets .....7 25@7 50
IX 12x12 225 sheets .....7 50@7 75
For each additional X add $1.00@3.00

Coke Tin Plate.

	Best	Ordinary
IC 10x14 } IC 14x20 }	$5 60	

Solder.

Half and Half, in bars warranted } Quotations
No. 1. Refined..... } only
Bingham..... } application.

Zinc.

in c, cask 6¾
in c, open 7

LEAD.

Pig..... }
Bar ₱ lb..... } Quotations
Pipe ₱ lb..... } on
Sheet. ₱ lb..... } application
Chilled Shot ₱ bag 25 lbs..... }

BABBIT METAL.

No. 4.....6
Allens.....9¼
Excelsior.....15
W. B. Genuine.....25

COPPER.

Lake Ingot.....18
Arizona.....17¼

IRON AND STEEL

Flat Bar

1½ to 4 by ⅜ to 1 inch.....1 75
4½ to 6 by ⅜ to 1 inch.....1 85
1¾ to 6 by 1⅛ to [illegible] inch.....2 15
1¼ &1¾ by ⅜ to [illegible].....1 85
1 &1⅛ by ⅜ to ¾ 1 85
⅝, ¾ and ⅞ by ⅜ to ⅝.....2 25

Round and Square.

1 to 1⅞ inch.....1 75
2 to 2⅝ 1 95
2¾ to 3¼ inches.....2 25
3⅜ to 4 .....2 75
4¼ to 4½ 3 25
4¾ to 5 .....3 45

Oval.

⅜ to 1¼ inch.....2 15
½ to ¾ 2 35
⅞ 2 55
1 .....2 95

Half Oval and Half Round.

1¼ to 3 inch.....2 85
⅛ to 1½ 2 45
⅝ to ¾ 2 95
⅞ 3 25
1 .....4 75

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch.....1 95
1 to 1⅝ by ¼ and 5-16 inch.....2 05
¾ to ⅞ by ¼ and 5-16 inch.....2 25
1 to ⅝ by ¼ and 5-16 inch.....2 75

Hoops.

1¼ to 4, Nos. 13 to 15.....2 55
1½ to 2, Nos. 16 to 18.....2 65
1¼ to 2, No. 19.....2 75
1¼ to 2, No. 20.....2 85
1¼ to 2, No. 21.....2 95
1¼ to 2, No. 22.....3 05
15-16, 1 and 1⅛, Nos. 13 to 15.....2 75
15-16, 1 and 1⅛, Nos. 16 to 18.....2 85
15-16, 1 and 1⅛, Nos. 19 and 20.....2 95
15-16, 1 and 1⅛, No. 21.....3 05
15-16, 1 and 1⅛, No. 22.....3 25
⅞, Nos. 13 to 15.....2 95
⅞, Nos. 16 to 18 .....3 05
⅞, Nos. 19 and 20.....3 15
⅞, No. 21.....3 25
⅞, No. 22.....3 35
13-16, Nos. 13 to 15.....3 15
13-16, Nos. 16 to 18.....3 25
13-16, Nos. 19 and 20.....3 35
13-16, No. 21.....3 45
13-16, No. 22.....3 55
¾, Nos. 13 to 15.....3 25
¾, Nos. 16 to 18. .....3 35
¾, Nos. 19 and 20.....3 45
¾, No. 21.....3 55
¾, No. 22.....3 65
11-16, Nos. 13 to 15.....3 45
11-16, Nos. 16 to 18 .....3 55
11-16, Nos. 19 and 20.....3 65
11-16, No. 21.....3 75
11-16, No. 22.....3 85
⅝, Nos. 13 to 15.....3 85
⅝, Nos. 16 to 18.....3 75
⅝, Nos. 19 and 20.....3 95
⅝, No. 21.....4 05
⅝, No. 22.....4 15
⅝, No. 23.....4 25

Light Band

1¼ to 6 by ¼ to 3-16 in.....2 25
1½ to 6 by Nos. 11 and 12.....2 35
1 to 1⅝ by ⅛ to 3-16 in.....2 35
1 to 1⅝ by Nos. 11 and 12.....2 45
⅞ and 13-16 by ⅛ to 3-16 in.....2 65
⅞ and 13-16 by Nos. 11 and 12.....2 75
¾ and 11-16 by ⅛ to 3-16 in.....2 95
¾ and 11-16 by Nos. 11 and 12.....3 05
⅝ and 9-16 by ⅛ to 3-16 in.....3 25
⅝ and 9-16 by Nos. 11 and 12.....3 30
½ by ⅛ to 3-16 in.....3 50
½ by Nos. 11 a d 12.....3 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12.....2 75
⅞ inch, " " " 13 and 14.....3 05
¾ inch, " " " 11 and 12 .....3 05
¾ inch " " " 13 and 14 .....3 25

Sheet Iron.

No. 10 to 4.....2 50
No. 15 to 17.....2 70
No. 18 to 21.....2 90
No. 22 to 24.....2 90
No. 25 to 26.....3 00
No. 27.....3 10
No. 28 .....3 30

Iron Boiler Plates.

Tank, ¼ inch and heavier.....2 35
C No. 1, " 2 60
C H No. 1, " 2 85
C H Flange, " 3 55
Extra Flange, " 3 95
Solid Fire Box, " 4 85

Steel Boiler Plates—1-4 in. and heavier.

Tank $2 55
Shell $2 95
Flange.....$3 20
Marine Flange.....$3 70
Fire Box.....$4 35
Above includes plates 90 inches wide.
90 to 96 in. wide..... ¼c. ₱ lb extra.
96 to 100 in. wide.....1 c. "
100 to 104 in. wide.....1½c. "
104 to 116 in. wide.....special.

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON. cts. ₱ lb

to 2 in. inclusive.....	.09
9-16 to ½ in. "	.09
7-16 to ⅝ and 2⅛ to 3 in.....	10¼
3⅛ to 4 in.....	.11
⅝ to 11-16 an 4⅛.....	.10¼

TRAVELER'S REGISTER.

Standard Time.

Revised March 6th, 1888.

N. Y. C. & St. L. R. R. Co.—"The Nickel Plate."

EASTWARD.	ARRIVE.	DEPART
Buffalo Passenger	10 40 a m	10 45 a m
Chicago Passenger	9 20 p m	.....
Local Freight	4 40 p m	7 30 a m
WESTWARD.	**ARRIVE.**	**DEPART.**
Chicago Passenger	.....	6 30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight	1 10 p m	5 50 a m

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.

Euclid Accommodation departs 6:24 a. m. 5:05 p. m.

All trains daily, except Sunday.

Cleveland & Pittsburg.

	ARRIVE.	DEPART.
New York Express	12 50 p m	7 45 a m
New York Express	6 55 p m	1 35 p m
Alliance & Akron Accom	9 35 a m	3 25 p m
Ravenna Accommodation	8 25 a m	5 00 p m
Night Express	* 5 25 a m	*11 10 p m

*Daily; all other trains daily except Sunday.

Mt. Vernon & Pan Handle Route

C., A. & C. Ry. Co.	ARRIVE.	DEPART.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 p m
Akron, Col. & Zanesv'e Ex.	12 50 p m	1 35 p m
Akron & Orrville Accom	9 35 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily except Sunday.

Erie Railway.

Depot, South Water St. and Viaduct.

	ARRIVE.	DEPART.
N. Y. & Pitts. Express	15 58 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommodation	.....	†6 40 a m
Pittsburgh Express	† 6 25 p m	.....
Youngstown Local	†8 05 a m	.....
Mahoning div. and Pitts Local	.....	*11 40 a m
Mahoning Val Accom	.....	*4 30 p m
Pittsburgh Express	†1 20 p m	11 10 p m
New York Express	*8 00 p m	.....

* Daily. † Daily except Sunday. ‡ Daily except Monday.

Cleveland and Canton Railroad.

Arrive.—Canton, Sherrodsville and Coshocton 9 55 a.m., 7 00 p.m.

Kent —*7 50 a.m., *7 16 p.m.

Bedford—*7:50 a.m., 1:05 p.m., 7 16 p.m.

Newburgh and Miles avenue—7:10 a.m., 4:15, p.m. 5:33 p.m.

Depart—

Canton, Sher'dsville & Cosh't'n—7:00 a.m. and 3:10 p.m.

Kent—*8:38 a.m. and *8:36 p.m.

Bedford—*8:38 a.m., 4:45 p.m., 11:10 a.m., 5:45 p.m.

Newburgh and Miles Avenue—6:12 a.m., 2:00 p.m., 4:40 p.m.

Trains marked with * run daily. All others daily except Sunday.

Depot at Ontario street, one block east of Huron street

Valley Railway.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail	*7 45 a m	*6 30 p m
Marietta Express	†11 15 a m	†2 30 p m
Valley Junction Express	* 4 15 p m	*10 15 a m
Cleve. & Canton Ex.	° 7 00 p m	†8 15 a m

*Daily.

†Daily, except Sunday.

WM. THORNBURGH, Gen. Manager, R. A. CARRAN, Gen. Pass. Ag't.

Cleveland, Lorain and Wheeling.

	DEPART.	ARRIVE.
Wheeling Express	6 45 a m	6 55 p m
Uhrichsville Express	4 00 p m	9 20 a m

Cleveland & Marietta R. R.

THROUGH LINE BETWEEN

Marietta, Caldwell, Cambridge, Newcomerstown, Canal Dover, Canton, Akron, Cleveland, Buffalo, Toledo Pittsburgh, New York, Coshocton, Newark, Zanesville, Columbus, Chicago and St. Louis.

In effect December 2, 1888.

GOING NORTH.			GOING SOUTH.	
No. 4.	No. 2.	STATIONS.	No. 1.	No. 3.
9 50 AM	2 00 AM	..Parkersburg...	2 45 PM	11 45 PM
11 50	6 45	.....Marietta.....	10 00 AM	7 03
12 53	7 50	.....Elba.....	8 56	5 59
1 00	7 57	... Macksburg...	8 49	5 52
1 07	8 04	..Dexter City...	8 42	5 45
1 11	8 09	..South Olive...	8 38	5 40
1 25	8 25	.....Caldwell.....	8 25	5 26
1 35	8 35	..Belle Valley...	8 10	5 16
1 56	8 56	..Pt. Pleasant...	7 47	4 54
2 0	9 08	.....Byesville.....	7 33	4 40
2 28	9 27	...Cambridge...	7 14	4 24
2 57	9 50	...Kimbolton....	6 47	3 57
3 15	10 13	N. Comerstown	6 25	3 35
3 57	10 55	..Canal Dover..	5 45 AM	2 53
4 17	11 17	ar. Vall'y J'n. lv		2 30
.....	.....	lv. Vall'y J'n. ar		.....
	12 15 PM	.....Canton.....		1 28
	1 15	.....Akron.....		12 30
	2 46	... Cleveland....		11 15 AM
	8 15	.....Buffalo		5 40
11 15 PM	6 20	.....Toledo.....		7 45

Train No. 8 leaves Marietta at 3 00 p. m. Whipple 4 00, Warner 4 15, Elba 4 35, Macksburg 4 45, Dexter City 4 55, Caldwell 5 26, arriving Cambridge 7 00 p. m. Train No. 5 leaves Valley Junction at 4 50 p. m., arriving at Canal Dover 5 15 p. m.

Through coaches on trains Nos. 2 and 3 between Marietta, Canton, Akron, Clevland, and Toledo. Close connections made at Marietta with C., W. & B., M., C. & N., Z. & O., and Ohio ver Packets; at Cambridge with the B & O. east and west; at Newcomerstown with P., C. & St. L. east and West; at Canal Dover with C., L. & W. and C. & P., north and east; at Valley Junction with W. & L. E. and Valley R'y.

W. K. RICHARDS, Gen. Pass. Agt.

A. T. WICKOFF, Gen. Manager.

THE FAVORITE

AND

Picturesque Route

TO

New York, Boston and the East.

THE SHORTEST AND QUICKEST ROUTE TO PITTSBURGH, WASHINGTON AND BALTIMORE, AND THE SOUTHEAST.

Change of time goes into effect May 20, 1888.

Central, or Ninetieth Meridian time, 33 minutes slower than Cleveland city time.

Until further notice trains will leave from the New Central Depot, South Water Street and Viaduct, as follows:

	Depart.
No. 62, Mahoning Valley Accommo	† 6 40 a m
No. 72, New York Express	* 8 30 a m
No. 72, Fast Pittsburgh Express	* 8 30 a m
No. 64, Fast New York Express	* 3 00 p m
No. 64, Pittsburgh Express	* 3 00 p m
No. 66, Youngstown Accommo	* 5 00 p m
No. 68, Pittsburgh Express	†11 10 p m
No. 68, New York Express	†11 10 p m
No. 70, Pittsburgh Local Express	*11 40 a m
No. 74, Shenango Valley Express	† 4 00 p m
	Arrive.
No. 73, Shenango Valley Express	† 9 25 a m
No. 61, New York Express	† 5 45 a m
No. 61, Pittsburgh Express	† 5 45 a m
No. 65, Fast New York Express	*10 55 a m
No. 65, Pittsburgh Express	*10 55 a m
No. 67, Pittsburgh Express	† 1 20 p m
No. 63, New York Express	* 7 05 p m
No. 69, Pittsburgh Express	* 8 40 p m
No. 77, Youngstown Local	* 7 25 a m
No. 13, Erie Express, carrying express matter only, from all points East and South-east, carries no passengers (except Monday)	† 1 20 p m.

* Daily. † Daily, except Sunday.

☞ This is the only route by which passengers can reach Corry, Elmira, Binghampton, New York City and intermediate points without change. No change to Boston and New England cities.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Central Depot, South Water street and Viaduct, Cleveland. Ship by Erie Express.

E. B. THOMAS, 2d Vice President, Cleveland, O.

L. P. FARMER, Gen'l Pass. Agent, New York.

W. C. RINEARSON, Ass't G. P. A., Cincinnati, O

M. L. FOUTS, City Passenger Agent. 141 Superior Street, Weddell House, Cleveland, O.

The Picturesque Lehigh Valley Route.

Two through trains with Pullman cars attached are now run via by this beautiful scenic route, between Suspension Bridge, Buffalo, New York and Philadelphia, leaving Suspension Bridge 8:35 A. M. and 3:40 P. M., Buffalo 9:15 A. M. and 5: P. M., connecting with all trains from the West.

Passengers between the East and West passing over the famed LEHIGH VALLEY ROAD will experience the pleasure of a trip through the most magnificent and picturesque scenery in the world, presenting an ever varying panorama of delightful surprises.

Double track, steel rails, magnificent road bed and unrivaled equipment, all combine to make the LEHIGH VALLEY the favorite and most desirable route between the East and the West.

Anthracite Coal is used entirely, guaranteeing the passengers perfect freedom from the dense volumes of smoke that so greatly annoy passengers on lines using Bituminous Coal.

E. B. BYINGTON, Gen'l Pass. Agent, South Bethlehem, Pa.

Pittsburgh & Lake Erie Railroad.

On and after Jan. 2, 1888, passenger trains will depart from and arrive at the Pittsburgh and Lake Erie Depot at Pittsburgh, as follows, Central time:

P. & L. E. R. R. Depart for—	
No. 1, Cleveland, Bradford and East,	5 25 a.m
No. 5, Buffalo, St. Louis, Cleveland	7 45 a.m
No. 5, Beaver Falls Accommodation	8 40 a.m
No. 7, Buffalo, New York, and all New England points,	10 15 a.m
No. 9, Chicago, Cincinnati, St. Louis,	1 10 p.m
No. 11, Buffalo Express	3 30 p.m
No. 13, Beaver Falls Accommodation	5 20 p.m
No. 15, Buffalo Express	10 30 p.m
Arrive from—	
No. 2 Beaver Falls Accommodation,	5 25 a.m
No. 4, Buffalo and Cleveland Night Exp.	6 55 a.m
No. 6, Youngstown Accommodation,	9 20 a.m
No 8 Beaver Falls Accommodation,	12 40 p.m
No. 10, Chicago, Cincinnati & St. Louis,	1 35 p.m
No. 12, Buffalo Express,	5 45 p.m
No. 14, Cincin., St. Louis and Cleveland,	8 05 p.m
No. 14, Cleveland & Buffalo Express	10 35 p.m

Pittsburgh & Lake Erie trains Nos. 4, 15, 8 and 10 daily.

E. HOLBROOK, General Superintendent.
R. W. JONES, Master of Transportation.
D. SMITH, Gen'l Pass. Ag't. Pittsburgh

A. I. BABBITT.

The only genuine Allen's Black Lead Compound Babbit. Perfect satisfaction guaranteed. The cheapest metal made quality considered. Address all orders to W. L. FAY & CO., Sole Mfrs., Elyria, O.

WHEELING & LAKE ERIE

TIME TABLE—IN EFFECT NOV. 25, 1888

Central Standard Time.

EASTWARD.	No. 5.	No. 7.	No. 9.*	No. 13*
Toledo.....lv	7 45 AM	1 10 PM	4 50 PM	7 45 PM
Oak Harbor...ar	8 41	2 07	5 45	10 00
Fremont	9 06	2 33	6 10	.....
Clyde	9 22	2 49	6 25	.....
Bellevue	9 37	3 04	6 40	.....
Monroeville..lv	9 56	3 20	6 58	2 05 AM
Norwalk	10 10	3 40	7 17	2 17
Wellington	11 00	4 30	8 12	2 55
Creston	11 53	5 17	9 20	3 42
Orrville.....ar	12 20 PM	5 45	9 50PM	4 10
Orrville.....lv	12 40	6 05	6 35 AM	6 35
Massillon.....ar	1 20	6 45	7 18	7 18
Massillon.....lv	1 20	6 45	7 18	7 18
Navarre	1 35	7 00	7 35	7 10
Valley Junc.lv.	2 20	7 35	8 20	8 20
New Cumberl'd	2 23	7 48	8 40	8 40
Sherrodsville	2 45	8 00	9 00	9 00
Leesville	2 52	8 08	9 20	9 20
Bowerston....ar	2 58PM	8 15PM	9 30AM	9 30AM
Canal Dover	3 53 PM	.....	.....	.....
New Comerst'n	3 95	.....	.....	.....
Cambridge	4 24	.....	.....	.....
Macksburg	5 52	.....	.....	.....
Marietta.....ar	7 03 PM	.....	.....	.....

WESTWARD.	No. 6.	No. 8.	No. 4.	No. 2.*
Marietta.....lv	6 45 AM	11 50 AM	.....	.....
Macksburg	7 57	1 00 PM	.....	.....
Cambridge	9 27	2 28	.....	.....
New Comerst'n	10 13	3 15	.....	.....
Canal Dover	10 55 AM	3 57PM	.....	.....
Bowerston	10 45 AM	3 50PM	5 55 AM	.....
Leesville	10 52	3 57	6 02	.....
Sherrodsville	11 00	4 05	6 10	.....
New Cumberl'd	11 12	4 17	6 22	.....
Valley Junc	12 10 PM	4 35	6 45	.....
Navarre	12 45	5 10	7 35	.....
Massillon	1 05	5 25	8 00	.....
Orrville.....ar	1 40	6 05	8 58	.....
Orrville.....lv	1 45	6 35*	9 13	.....
Creston	2 18	7 04	9 42	.....
Wellington	3 06	7 43	10 33	.....
Norwalk	3 55	8 30	11 30	7 25 AM
Monroeville	4 07	8 40	11 45	7 35
Bellevue	4 23	9 45	11 59	7 51
Clyde	4 39	10 00	12 15 PM	8 06
Fremont	4 55	10 17	12 30	8 23
Oak Harbor	5 20	.....	12 53	8 45
Toledo.....ar	6 20 PM	11 15*	1 50 PM	9 40 AM

No. 27	No. 25	Huron Divis'n.	No. 26	No. 28
4 50 PM	7 40AM	Ar.. Huron ..Lv	8 55 AM	5 30PM
4 32	7 22	Friese Landing	9 10	5 45
4 20	7 10	.....Milan.....	9 28	6 03
Lv 3 55	Lv 6 45	.....Norwalk.....	Ar 9 55	Ar 6 30
Ar 3 30	Ar AM		Lv 11 30	Lv 8 30
3 20 PM	.....	...Monroeville..	11 45 AM	8 40 AM

* Daily.

Train No. 13 leaves Toledo *7 45 p. m.; arrive Monroeville 12 15 a. m. and Norwalk 12 35 a. m

This road is now open through from Toledo to Bowerston, connecting with the Pennsylvania System for all points East.

THROUGH CAR SERVICE.

Between Toledo, Cambridge and Marietta.
" " and Bowerston.
" " and Akron, Youngstown and Pittsburgh.
" Chicago, Akron, Youngstown and Pittsburgh.

M. D. WOODFORD, Gen'l Manager. JAMES M. HALL Gen'l Pass. Agt.

Scioto Valley Railway

TIME TABLE.

In effect May 27, 1888.

THE SHORT LINE TO ALL POINTS

North and South, East and Southeast, West and Northwest.

TRAINS GOING SOUTH.

STATIONS.	No. 2.	No. 4.	No. 6.
Columbus.....Lv	7 10 a.m	11 25 a.m	5 25 p.m
Valley Crossing	7 30 "	11 44 "	5 45 "
Lockbourne	7 41 "	11 53 "	5 56 "
Ashville	7 55 "	12 07 p.m	6 10 "
Circleville	8 15 "	12 26 "	6 30 "
Kingston	8 34 "	12 44 "	6 49 "
Chillicothe	9 01 "	1 30 "	7 35 "
Sharon	9 36 "	2 05 "	8 10 "
Waverly	9 46 "	2 14 "	8 20 "
Piketon	9 58 "	2 27 "	8 33 "
Big Run	10 12 "	2 41 "	8 47 "
Lucasville	10 27 "	2 57 "	9 03 "
Portsmouth	10 50 "	3 20 "	9 25 "
Sciotoville	11 05 "	3 35 "	9 40 "
Wheelersburg	11 10 "	3 40 "	9 45 "
Havernill	11 29 "	3 59 "	10 04 "
Hanging Rock	11 40 "	4 10 "	10 15 "
Ironton	11 50 "	4 20 "	10 25 "
Petersburg	12 00 m.	4 30 "	10 35 "
Ashland.....Ar	12 30 p.m	5 00 p.m	11 05 p.m

Trains Nos. 2 and 4 daily, except Sunday.
Train No. 6 daily.
Train No. 6 takes supper at Chillicothe.

TRAINS GOING NORTH.

STATIONS.	No. 1.	No. 3.	No. 5.
Ashland.....Lv	2 45 a.m	9 05 a.m	5 35 p.m
Petersburg	3 15 "	9 35 "	6 05 "
Ironton	3 26 "	9 46 "	6 15 "
Hanging Rock	3 36 "	9 56 "	6 25 "
Havernill	3 46 "	10 07 "	6 36 "
Wheelersburg	4 06 "	10 28 "	6 55 "
Sciotoville	4 12 "	10 33 "	7 00 "
Portsmouth	4 27 "	10 05 "	7 15 "
Lucasville	4 49 "	11 14 "	7 37 "
Big Run	5 04 "	11 32 "	7 53 "
Piketon	5 18 "	11 48 "	8 07 "
Waverly	5 30 "	12 01 p.m	8 20 "
Sharon	5 40 "	12 11 "	8 30 "
Chillicothe	6 35 "	1 10 "	9 06 "
Kingston	7 01 "	1 26 "	9 31 "
Circleville	7 20 "	1 36 "	9 49 "
Ashville	7 40 "	1 55 "	10 08 "
Lockbourne	7 55 "	2 15 "	10 22 "
Valley Crossing	8 08 "	2 39 "	10 31 "
Columbus.....Ar	8 30 a.m	3 00 p.m	10 50 p.m

Train No. 1 daily.
Trains Nos. 3 and 5 daily, except Sunday.

COUPON TICKETS, by the best routes and to all principal points in the United States and Canada, can be found at the following Stations: Columbus, Circleville, Kingston, Chillicothe Waverly, Portsmouth, Ironton, A. C. & I. Ashland.

For further information relative to rates, connections and through time, call on your Ticket Agent, or address J. ROBINSON, Receiver.

JNO. J. ARCHER, Gen'l Pass. & Ticket Ag't, Columbus, Ohio

Ft. Wayne, Cincinnati & Louisville RAILROAD.

THE POPULAR ROUTE

BETWEEN THE

NORTH and SOUTH

THE DIRECT ROUTE TO OR FROM FORT WAYNE, INDIANAPOLIS, TERRE HAUTE, EVANSVILLE, AND ST. LOUIS.

13 MILES SHORTER —BETWEEN— 13

Fort Wayne and Indianapolis

Than any other Route.

22 MILES SHORTER AND QUICKER 22

By 3 HOURS, Between

Louisville and Fort Wayne.

Ask for Tickets

—VIA—

Ft. Wayne, Cincinnati & Louisville Railroad.

For sale by all Agents of connecting lines. EAST, WEST, NORTH AND SOUTH.

W. W. WORTHINGTON, Gen'l Supt. S. A. WIKEL, Gen'l Ticket Agent, FORT WAYNE, IND.

WEST'S

MOULDERS' TEXT-BOOK:

BEING PART II OF

AMERICAN FOUNDRY PRACTICE.

Presenting best methods and original rules for obtaining good, sound, clean castings, and giving detailed description for making moulds requiring skill and experience.

Also containing a practical treatise upon the construction of cranes and cupolas, and the melting of iron and scrap steel in iron foundries. By

THOMAS D. WEST,

Practical iron moulder and foundry foreman member of the American Society of Mechanical Engineers and of the Civil Engineers' Club of Cleveland, Ohio.

12mo. Cloth, $2,50

Fully illustrated and with complete index Will be mailed, prepaid, on receipt of the price.

On receipt of $3.00 we will send the above book and the IRON TRADE REVIEW for one year

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CLEVELAND, OHIO.

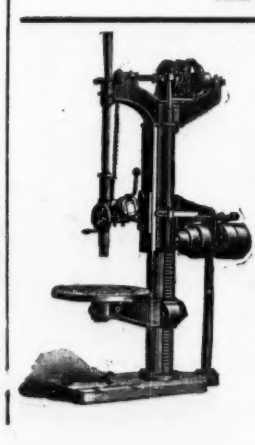
E. A. Schumacher

Manufacturer of

UPRIGHT DRILLS,

249 Sycamore St., Cincinnati, O.

S. M. YORK, Agent for Cleveland, O.



⅛ to 6 in.	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. lb
2 to 9-16 wide by 2 to ⅝ thick	0

Bessemer and O. H. Steel.

	cts. lb.
Machinery	base price. 02¾
Tire	" 02¾
Spring	03½
Sleigh Shoe	02¾
Toe Calk	03
Cutter Shoes, tapered and burr	03

For extra sizes, see classification below.

Machinery Steel.

ROUNDS AND SQUARES.

	cts. per lb ex.
1 to 3 in. incl.	base
3⅛ to 4 "	0.3
4⅛ to 6 "	1.0
¼ to 15-16 "	0.2
⅛ to 11-16 "	0.3
⅝ to 7-16 "	0.4
5-16 to 11-32 "	0.5
½ and 9-32 "	0.7
Machine cutting, specified lengths, ab'e 24 in	0.2
Machine cutting, specified lengths, 12 to 24 in	0.4

Machine cutting to specified lengths less than 12 inches, according to contract, but not less than 0.6 cents on each size extra. Sawing, one-half of the above extra for cutting.

FLATS.

	cts. per lb ex.
1½ to 6 in., by 5-16 to 1 in. thick	base
1½ to 6 in., by ½ and 9-32 in. thick	0.2
1½ to 6 in., by 3-16 and 7-32 in. thick	0.3
1½ to 6 in., by ⅛ and 5-32 in. thick	0.4
⅝ to 1 7-19 in., by ¼ to 1 in. thick	0.3
⅝ to 1 7-16 in., by 3-16 and 7-32 in. thick	0.4
⅝ to 1 7-16 in., by ⅛ and 5-32 in. thick	0.5
⅝ to 11-16 in., by ¼ to ½ in. thick	0.4
⅝ to 11-16 in., by 3-16 and 7-32 in. thick	0.6
⅝ to 11-16 in., by ⅛ and 5-32 in. thick	0.8
⅝ to ¾ in., by 1-16 and 3-22 in. thick	2.0
13-16 to 1½ in., by 1.16 and 3-32 in. thick	1.5
1¼ to 3 in., by 1-16 and 3-32 in. thick	1.0

These extras apply on Tire, Toe-Calk, Shoe and Flat Machinery Steel, also on Cutter Shoes.

SPRING STEEL FLATS.

	cts. ex.
1¼ to 4 in. by No. 4 gauge to ½ in. inclusive,	base
1 and 1½ in. by No. 1 gauge to 4 gauge "	0.2
1 to 3 in. by No. 5 gauge to 7 gauge "	0.5
⅛ to 3 in. by No. 8 gauge to 10 gauge "	1.0
¾ to 3 in. by No. 11 gauge to 16 gauge "	2.0
¾ to 3 in, by No. 17 gauge to 20 gauge "	3.5
⅝ to ⅝ in. by No. 10 gauge to 16 gauge "	4.0
⅝ to ⅝ in. by No. 17 gauge to 20 gauge "	5.0
⅝ to ⅝ in. by No. 21 gauge to 24 gauge "	6.0.

Bessemer and Open Hearth cut to length, 24 inch and over 1-10 cent per lb. extra, and under, y special contract.

ROUND SPRING STEEL.

	cts. ex
⅝ to 1½ inches	base
¼ to 9-16 inches	0.2
⅝ to 7-16 inches	0.5
5-16 inches	1.0
¼ inches	1-5

English Tool Steel.

Jessops	16c
Hob on's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

Rolls and Castings.

Furnace floor and straightening plates	1¼c
Housings and castings not otherwise specified	1¾c
Guide plates	2½c
Spindles and coupling boxes	1¾c
Sand rolls and pinions, large size	2 c
Sand rolls and pinions, small size	2½c
Pipe mill castings	3 c
Rolling mill castings under 50 lb	2 c
Spur and bevel wheels, large	3 c
Spur and bevel wheels, small	3½c
Pulleys up to 30 inches	4 c
Pulleys over 30 inches	3½c
Engine castings, light	3¼c
Engine castings, heavy	2¾c

SCRAP IRON AND OLD METAL

	Net Ton.
No. 1 R. R. wrought scrap	$23 00
No. 1 wrought scrap	20 00
No. 1 Machine cast scrap	15 00
Stove plate (free from burnt iron)	10 50
Grate bars	11 00
Pipes and flues (Clean)	13 00
Tank iron	12 50
Hoop and band iron	10 00
Iron axles	28 00
Light sheet iron	10 00
Axle turnings	16 00
Wrought turning (free from cast)	15 00
Wrought iron, oily drillings	14 00
Cast borings	11 00
Malleable iron	10 50
Uncut wrought iron boilers	10 00
Steel boiler plates	14 50
Old iron T rails	gross tons $27 00
Old steel rails	23 00
Car wheels	20 00
Old copper	per lb 7
No. 1. H. red Brass	8½
Heavy yellow brass	6½
Light yellow Brass	6
Scrap Zinc	3
Tea Lead	3
Heavy Lead	3¼

WROUGHT IRON PIPE.

DISCOUNTS.

	Discount Per Ct.
Wrought iron pipe: Butt black X str	
XX str	50
Wrought iron pipe: Lap black X str	
XX str	60
Wrought iron pipe: Butt galv	40
" " Lap "	50
Lap-welded boiler tubes	50
" drive pipe	
" casing	
Lead pipe per lb	
Sheet lead "	
Galvanized spiral pipe	50
" " fittings	30
Patent adjustable ells	40
Globe ventilators	60
Tin tubing	50
Fittings for same	30
Expanding conductor pipe and fittings	40
Cast iron piece fittings for wrought iron pipe, black and galv	70
Bushings and plugs	75
Malleable unions	65
" flange unions	72½
Long screws	70
Gas pipe hooks	50
Cast iron flanges, manifolds and expansion pipe hangers	65
Hook, ring and expansion plates, coil stands	67½
Iron body: Globe, angle, check, cross, safety, butterfly, throttle, back pressure and foot valves	65&10
Iron body: Expansion joints and iron cocks, all iron	65&10
Iron body: Iron cocks with brass plugs	60&10
Straight way valves	
Brass: Globe, angle, check, cross safety, and radiator valves	60&10
Throttle and butterfly valves	50&10
Brass: Fin. globe valves, with finished brass wheels	40&10
Brass: Steam, service, meter and union meter cocks	57½&10
Brass: Expansion joints and steam bibbs	50&10
Mississippi gauge cocks	55
Bingham "	30
Gas proving pumps	50
Oil cups, lubricators and air cocks	60&10
Cocks for steam gauges	60&10
Cylinder cocks	50&10
Comp. gauge cocks	55&10
Water gauges, steam whistles and whistle valves	60&10
Gas fixture fittings	55
McNamara hydrants and street washers	Spec'l
Stop cock boxes	Spec'l
Galvanized wrought iron range boilers, to 52 gallons	65
Galvanized wrought iron range boilers, larger	50
Stands for same	40
Copper bath tubs	25
Closets	Spec'l
Cast iron soil pipe, to 6 in. inclusive	60
" " fittings, to 6 in. inclusive	65
Cast iron sinks	70
" slop sinks	60
Drive-well points	50
Ground key work: Rough and fin. plain, tray and bath bibbs } " " stops, shower stops, hydrant and ball cocks }	55&10
Compression: Rough and fin. plain, tray and bath bibbs	50&10
" " stops; urinal, hopper, hydrant and ball cocks	50&10
Basin cocks, from No. 1 to 13 inclusive	50&10
" " above No, 13, and double basin	40&10
Shampooing and sink cocks	40&10
Pantry cocks	50&10
Shampooing sprinklers	50&10
Double bath cocks and chain stays	50&10
Hose goods, plain and water back couplings	55&10
Boiler couplings, ground face, per set net, $1.25	10
Boiler couplings plain face, per set net, $1.20	10
Basin plugs and grates; bath, sink and wash tray plugs	60&10
Soldering nipples and unions	65&10
Union joints	60&10
End ferrules; street washer screws, checks and guides	55&10
Hydrant and basin clamps, hydrant sockets	55&10
Pipe taps, reamers and dies	60
Plain pipe tongs and gas plyers	50
Wrenches: Coe	50 & 5
" Girard agricultural	65
" " standard	60 & 5
" Stillson	33⅓
" Armstrong	25 & 5
" Bemis & Call	25 & 5
" Rouse	30
" Bauer's	10
Pipe tongs: Brown's adjustable	50
" Jarecki	50
" Robbins' chain	10
" Brock's	10
Vises: Plain pipe	55
" Smith comb	50
" Parker's comb	50
" Bauer's pipe and bolt	10
Machinists' Hammers	40
Copper "	Spec'l
Pipe cutters: Stanwood	20
" Eureka	45
" Saunders	40
" Barnes	50 & 5
Malleable oilers and hand lamps	Spec'l
Screwing stocks	60
Armstrong's adjustable stocks and dies	25&10
Waste, at manufacturer's prices.	
Gas fitters' cement	Spec'l
Hair felt	Spec'l
Riley Bros. cement	Spec'l
Otley Bros. steam packing	Spec'l
Mineral wool	Spec'l
Lubricating compound	Spec'l
Malleable iron fittings, black and galv	25
Wrought iron couplings and nipples, black and galv	70

Standard Wrought Iron, Steam, Gas and Water Pipe.

Nominal Size Inside Diameter.	Price per Foot, Black.	Price per Foot, Galvanized.	Thickness.	Nominal Weight per Foot.	No. of Threads per in. of Screw.	Price, Extra Threads.
In.			In.	Lbs.		
⅛	0 04	0 06	.068	0 24	27	0 05
¼	0 04	0 05	.088	0 42	18	0 05
⅜	0 04	0 06½	.091	0 56	18	0 05
½	0 05	0 07	.109	0 84	14	0 05
¾	0 07	0 09	.113	1 12	14	0 05
1	0 09½	0 12½	.134	1 67	11½	0 06
1¼	0 12½	0 17	.140	2 24	11½	0 07
1½	0 22	0 25	.145	2 68	11½	0 08
2	0 28	0 32	.154	3 61	11½	0 10
2½	0 44	0 49	.204	5 74	8	0 15
3	0 58	0 64	.217	7 54	8	0 20
3½	0 70	0 86	.226	9 00	8	0 25
4	0 85	1 00	.237	10 66	8	0 35
4½	1 00	1 25	.246	12 49	8	0 45
5	1 20	1 50	.259	14 50	8	0 55
6	1 65	2 00	.280	18 76	8	0 70
7	2 00		.301	23 27	8	0 85
8	2 75		.322	28 18	8	1 00
9	3 70		.344	33 70	8	1 20
10	4 75		.366	40 06	8	1 25
11	5 75		.375	45 02	8	1 50
12	6 50		.375	49 00	8	2 50
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Price per foot	23	23	23	24	22	25	28	31	34	38	43	45	52	60	72	86	1 00	1 45	1 85	2 25	2 75	3 25	3 55
Price, Lap-Welded Drive Pipe	8	10	12		15	25	22		30		40		50	60	66		90	1 20	1 65	2 20	3 00		4 50

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	12"	15"	18"	22"
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Size, Inside Diameter Nominal	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5 3-16	5⅝	6¼	6⅝	7⅝	8¼	8⅝	9⅝
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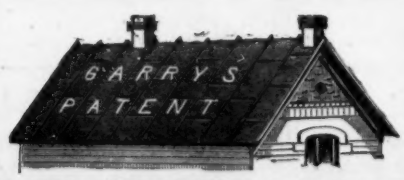

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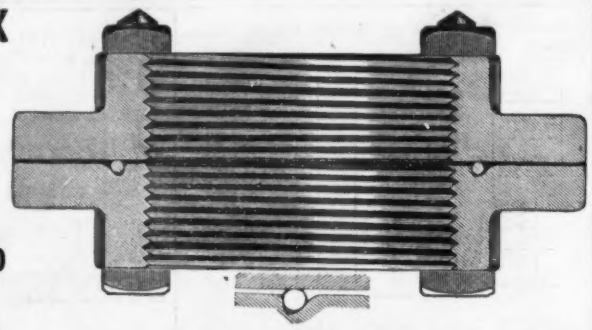

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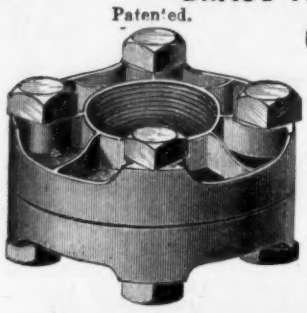

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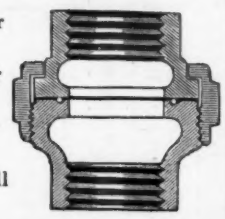

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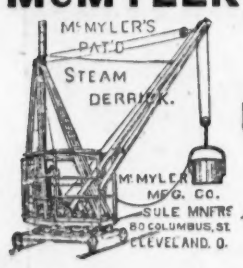

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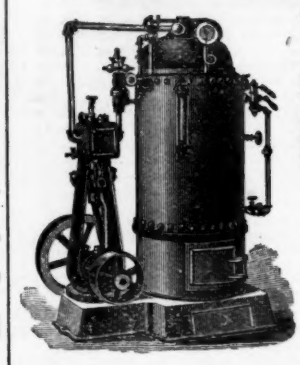

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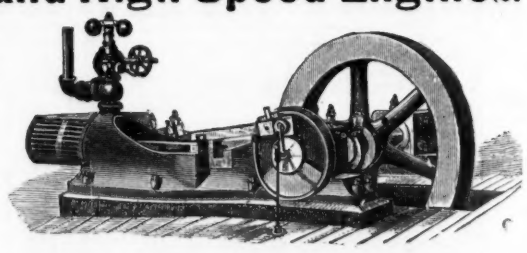

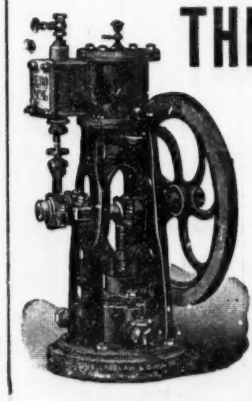

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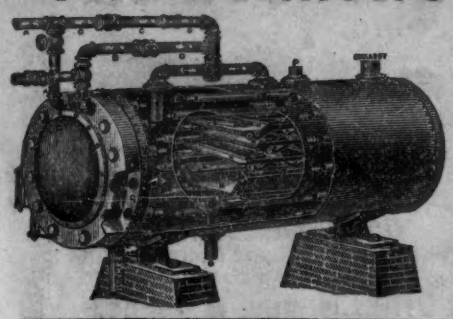

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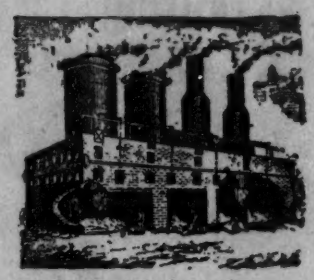

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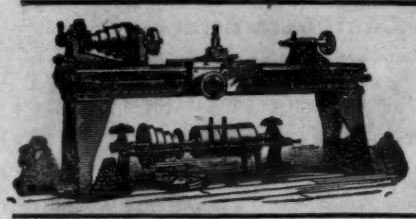

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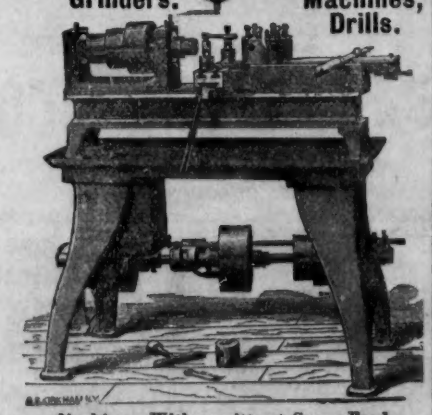

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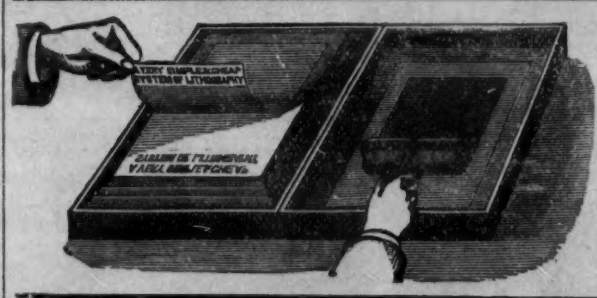

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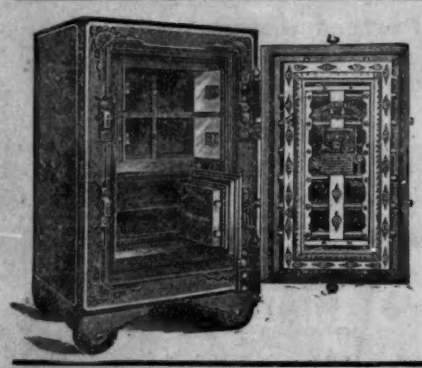

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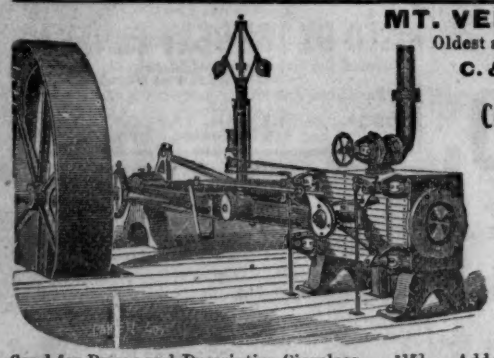

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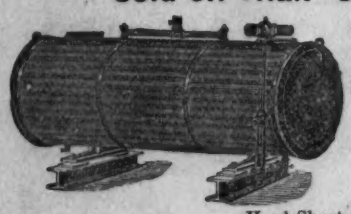

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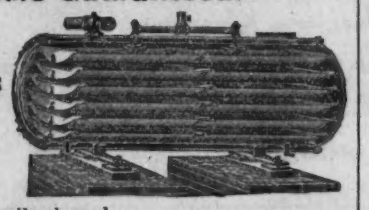

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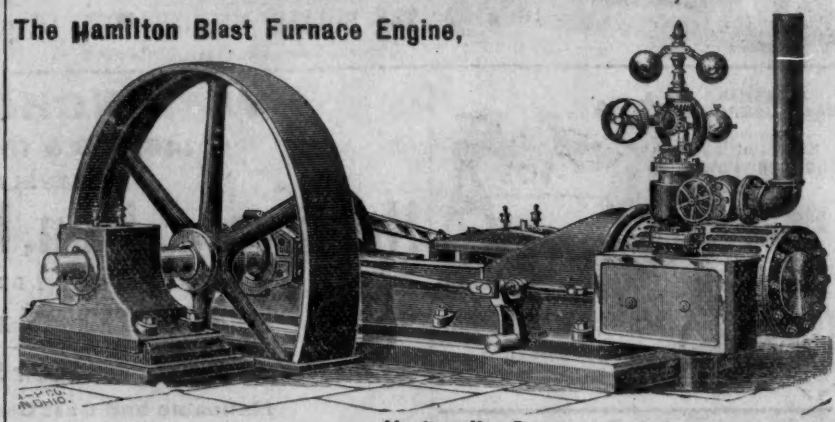

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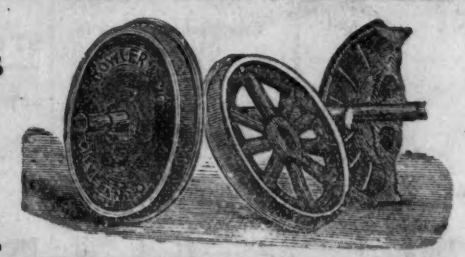

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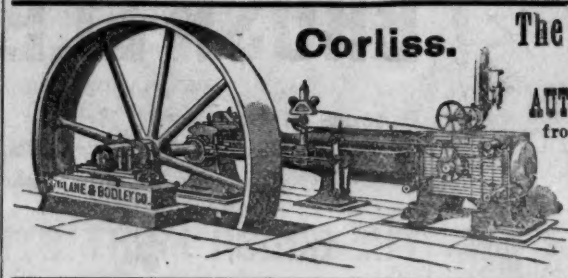

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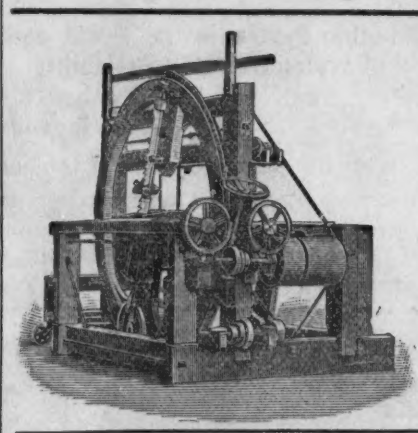

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